MONOCYTE DISTRIBUTION WIDTH (MDW) AS A TOOL FOR THE PREDICTION OF SEPSIS IN ICU

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Dedicated

to

my Family

my son Om

&

Teachers

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Dr. Arti Mona

LIST OF ABBREVIATIONS

ICU	INTENSIVE CARE UNIT
CRP	C-REACTIVE PROTEIN
PCT	PROCALCITONIN
MDW	MONOCYTE DISTRIBUTION WIDTH
ED	EMERGENCY DEPARTMENT
PAMPS	PATHOGEN-ASSOCIATED MOLECULAR PATTERNS
VCS	VOLUME, CONDUCTIVITY, AND SCATTER
TLC	TOTAL LEUKOCYTE COUNT
CBC	COMPLETE BLOOD COUNT
NLR	NEUTROPHIL-TO-LYMPHOCYTE RATIO
ACCP	THE AMERICAN COLLEGE OF CHEST PHYSICIANS
SCCM	THE SOCIETY OF CRITICAL CARE MEDICINE
SIRS	SYSTEMIC INFLAMMATORY RESPONSE SYNDROME
MODS	MULTIPLE ORGAN DYSFUNCTION SYNDROME
ESICM	EUROPEAN SOCIETY OF INTENSIVE MEDICINE
qSOFA	QUICK SEQUENTIAL ORGAN FAILURE ASSESSMENT
SOFA	SEQUENTIAL ORGAN FAILURE ASSESSMENT
GCS	GLASSGOW COMA SCALE
CKD	CHRONIC KIDNEY DISEASE
CLD	CHRONIC LIVER DISEASE
HTN	HYPERTENSION
CAD	CORONARY ARTERY DISEASE
COPD	CHRONIC OBSTRUCTIVE PULMONARY DISEASE
DM	DIABETES MELLITUS
SSI	SURGICAL SITE INFECTIONS

HR	HEART RATE
SBP	SYSTOLIC BLOOD PRESSURE
DBP	DIASTOLIC BLOOD PRESSURE
SPO2	OXYGEN SATURATION
RR	RESPIRATORY RATE
TEMP	TEMPERATURE

ABSTRACT

BACKGROUND: Patients in Intensive Care Units (ICU) are a high-risk population for sepsis, recognized as a major cause of admission and death. Although Procalcitonin (PCT) and C-reactive protein (CRP) are commonly used biomarkers, they have limitations in differentiating sepsis from other inflammatory conditions and in predicting outcomes. Monocyte Distribution Width (MDW), an in vitro hematological parameter available as part of a routine complete blood count (CBC), offers potential as a screening and diagnostic tool for sepsis in ICU.

AIMS AND OBJECTIVES: To assess the accuracy and diagnostic performance of MDW to identify patients who develop sepsis in ICU and to compare the diagnostic performance of MDW alone and in combination with clinical criteria and biomarkers.

MATERIALS & METHODS: We conducted a prospective observational study involving 100 patients with a suspected diagnosis of sepsis, in accordance with the sepsis 3 criteria. Patients were divided into two groups confirmed sepsis and probable sepsis based on positive culture sensitivity report or positive serology. Total leukocyte count and MDW levels were analyzed on the first day of enrollment and then monitored daily for a week. NL ratio and PCT values were also examined.

RESULTS: A total of 100 patients were enrolled in the study as per the sepsis 3 criteria. 52% of patients had confirmed diagnosis of sepsis and 48%of patients were classified as probable sepsis. MDW levels were significantly higher in confirmed sepsis patients (Median=32.23) across all observation days as compared to probable sepsis group (Median=20.81). MDW demonstrated good diagnostic performance for sepsis, with an AUC of 0.814. The optimal cutoff value for MDW was 22, yielding a sensitivity of 86.54% and a specificity of 62.50%, Positive Predictive Value (PPV) of 71.43% and Negative Predictive value (NPV) of 81.08%. MDW showed a strong positive correlation with other biomarkers, such as PCT, NL ratio, and TLC (Spearman's correlation coefficient of 0.629, 0.460 and 0.539 respectively). A multivariate logistic regression analysis showed MDW > 22 to be a significant independent predictor of sepsis ($p = 0.001$; odds ratio of 10.122).

CLINICAL SIGNIFICANCE: This study demonstrates that Monocyte Distribution Width (MDW) is a valuable and effective biomarker for diagnosing sepsis in critically ill ICU patients.

KEYWORDS: Sepsis, Monocyte Distribution Width (MDW), Procalcitonin (PCT), C-Reactive Protein (CRP), Complete Blood Count (CBC), NL Ratio (Neutrophil to leukocyte ratio), TLC (total leukocyte count), GCS (Glasgow Coma Scale).

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INTRODUCTION

Sepsis is a complex condition that arises from a dysregulatory host inflammatory response to systemic infection.[1] It continues to be one of the primary causes of mortality in intensive care units (ICUs) around the world, despite the limited understanding of its immunological and molecular mechanisms.[2] The lack of specific clinical indicators makes early identification of sepsis crucial for effective treatment and better patient outcomes.[3] Research indicates that mortality rates increase by as much as 8% for every hour that treatment is delayed, highlighting the critical need for swift management.[4]

Infections causing sepsis are typically diagnosed through a combination of blood cultures and characteristic physical symptoms. However, only 50% of sepsis patients with confirmed infections yield positive blood cultures, with the success rate dropping further if drawn during ongoing antibiotic treatment. Moreover, obtaining definitive results can take several days, delaying critical diagnosis.[5]

Given the lack of definitive sepsis biomarkers, inflammatory response proteins like C-reactive protein (CRP) and procalcitonin (PCT) are frequently employed to identify infections and predict outcomes in septic patients. Although PCT and CRP are widely utilized as biomarkers, their effectiveness in distinguishing sepsis from other inflammatory conditions or predicting outcomes is limited.[6-9]

As multiple clinical inflammatory conditions lead to systemic inflammatory response syndrome and overlap with sepsis, therefore for early diagnosis of sepsis in the ICU, there is a need to have laboratory biomarkers with high predictive value. Currently used clinical criteria and biomarkers have either poor sensitivity and specificity or high cost. Thus, we aimed to evaluate the novel laboratory biomarker, Monocyte Distribution Width (MDW), for its predictive value in identifying sepsis during its early stages.

Monocyte Distribution Width (MDW) is a useful measure that reflects the innate immune system's response to bacterial or fungal infections in the bloodstream, making it a significant biomarker for the prompt identification of sepsis. MDW can be obtained quickly during routine patient assessments through a complete blood count (CBC).[10]

Monocyte Distribution Width (MDW) is a hematological parameter measured in vitro and is the only FDA-cleared biomarker that aids in assessing the severity of infections and the risk of sepsis in adult patients in the emergency department (ED).[11] Monocytes, which are among the initial responders to infections in both blood and peripheral tissues, display functional and volumetric variability.[12] In cases of sepsis, monocytes undergo functional reprogramming in relation to macrophages, resulting in morphological changes. Consequently, MDW captures these alterations and has been proposed as a promising marker for the early identification of sepsis in the emergency setting.[10,13-14]

MDW offers insights into the variability of monocyte cell volume found in peripheral blood. When an infection occurs, monocytes quickly transform into their activated state, swiftly migrating from the bloodstream to the infection site. During this process, their size and volume undergo changes as they differentiate into amoeboid cells and enhance the expression of functional markers, such as CD16.[15-16] Accurately measuring these size alterations in monocytes can serve as an indicator of immune activation in patients with sepsis, potentially providing a valuable method for identifying early signs of infection in ICU patients. Thus, evaluating monocyte size variation using advanced hematology analyzers, such as the Beckman Coulter DxH series, presents a promising strategy for the early detection and monitoring of sepsis progression.[10]

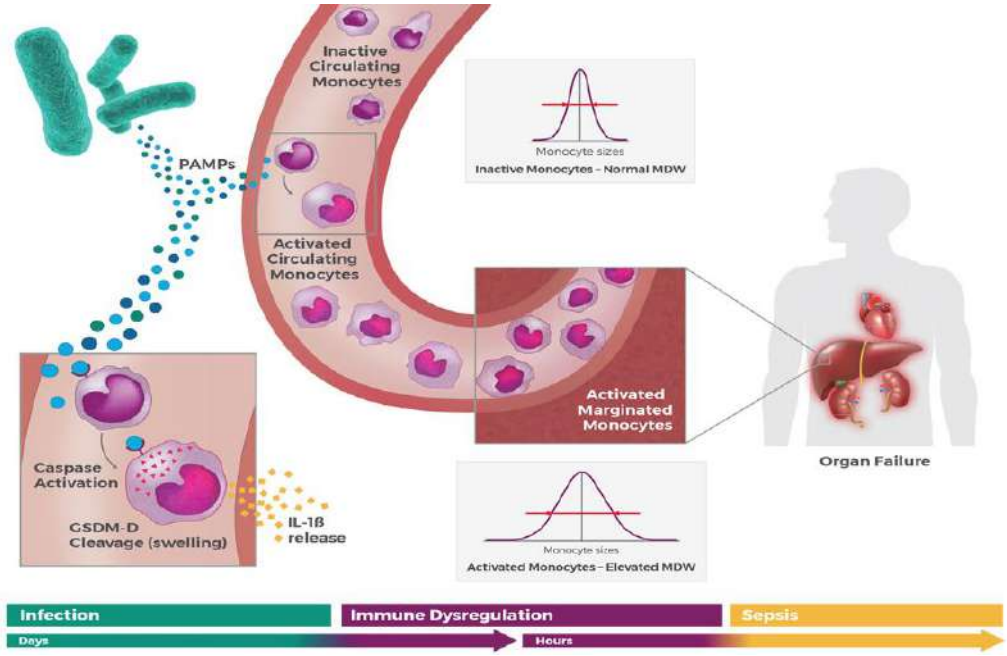

Figure 1: Illustrates the changes in circulating monocyte volume in response to pro-inflammatory signals from infectious agents, commonly known as pathogen-associated molecular patterns (PAMPs).[11]

The DxH 900 and DxH 690T hematology analyzers from Beckman Coulter utilize proprietary VCSn (volume, conductivity, and scatter) technology to analyze white blood cells (WBCs) in a state that closely resembles their natural form. This allows for the differentiation of various WBC types and generates a comprehensive 5-part differential, which includes neutrophils, eosinophils, monocytes, lymphocytes, and basophils. The system captures in-depth information about each WBC population, providing mean values and standard deviations for each parameter, known as cell morphometric parameters. Monocytes and neutrophils act as the initial defense against pathogenic infections. The accompanying inflammatory response can lead to their activation, resulting in morphological and functional alterations. Even subtle morphological changes are identifiable through the analyzer's proprietary near-native state characterization capabilities.[11]

MDW is valuable because it offers physicians an early warning of sepsis during the initial patient assessment, particularly when symptoms are mild and other diagnoses are possible. When used

alongside other clinical indicators, MDW helps clinicians adjust care levels for patients suspected of having an infection.

Although MDW is cost-effective and appears promising, there is a lack of strong evidence supporting its use in the ICU. Thus, we proposed conducting a study to evaluate the diagnostic performance of MDW as a sepsis marker in the ICU, both independently and in combination with other biomarkers.

AIMS AND OBJECTIVES

PRIMARY OBJECTIVE:

- To determine the positive predictive value of Monocyte distribution width (MDW) as a marker of sepsis in ICU.

SECONDARY OBJECTIVE:

- To compare the performance of Monocyte distribution width (MDW) alone and in combination with clinical criteria, Total leukocyte count (TLC) and biomarkers.
- To study the monitoring of response to antimicrobial therapy.

REVIEW OF LITERATURE

Sepsis is a serious global health issue, characterized by life-threatening organ dysfunction caused by an abnormal response to infection. It leads to millions of hospitalizations and deaths annually, with a mortality rate of about 30%, making it a major cause of death in critically ill patients outside of coronary care units. The incidence of sepsis is on the rise, particularly among individuals with pre-existing conditions or those already in hospitals. Early detection and treatment are crucial for improving patient outcomes and lowering healthcare costs associated with this condition.[19-20]

Over two millennia ago, Hippocrates described sepsis as a condition of rotting flesh and festering wounds. In the nineteenth century, the germ theory of disease, advanced by figures like Semmelweis and Pasteur, explained infection as the cause. However, in 1992, Bone and colleagues shifted the focus to the host's response, suggesting that the host, rather than the pathogen, plays a pivotal role in sepsis pathogenesis.[21]

Despite its ancient origins, understanding the true pathophysiology of sepsis took over 2,000 years. In 1914, Hugo Schottmueller sought to define sepsis, stating, "Sepsis occurs when a localized infection becomes a source from which pathogenic bacteria continuously or intermittently enter the bloodstream, producing both subjective and objective symptoms.[22]

Defining and managing sepsis proved difficult throughout the 20th century due to its complexity. Schottmüller's broad definition of sepsis as a pathogen invasion of the bloodstream endured for decades. However, the need for global guidelines led to multiple consensus efforts over the past 30 years.

Sepsis 1 - 1991[23]

The American College of Chest Physicians (ACCP) and the Society of Critical Care Medicine (SCCM) characterized sepsis as a continuous process, dividing it into several stages: Systemic Inflammatory Response Syndrome (SIRS), Sepsis, Severe Sepsis, Septic Shock,

and Multiple Organ Dysfunction Syndrome (MODS). These classifications have been widely utilized by healthcare professionals around the world.

- SIRS - any two of

1. Body temperature : > 38^{o} or < 36^{o} Celsius.
2. Heart rate (HR) : > 90 beats/minute.
3. Respiratory rate : > 20 breaths/minute or partial pressure of CO2 less than 32 mmHg.
4. WBC Count: White blood cell count (WBC) >12,000/cu mm, <4,000/cu mm, or >10% immature (band) forms

- Sepsis - SIRS with suspected or confirmed sepsis.
- Severe Sepsis – Sepsis plus organ dysfunction
- Septic Shock – sepsis-induced hypotension despite adequate fluid resuscitation with indicators of perfusion abnormality like lactic acidosis, oliguria, and altered mental status.

LACUNAS IN SEPSIS 1 DEFINITION [22]

The Systemic Inflammatory Response Syndrome (SIRS) can occur in the absence of infection, as it represents a generalized reaction to different kinds of stressors, such as trauma or burns. Inflammation, being a non-specific response, can be triggered by a variety of insults to the body.

In contrast, sepsis involves a complex interaction between pro-inflammatory and anti-inflammatory mechanisms and can range from hyper-inflammation and hypo-inflammation.

Sepsis 2 - 2001[24]

The SCCM, ACCP, ESICM, American Thoracic Society, and Surgical Infection Society gathered for a second consensus to revise and refine the sepsis criteria. In this update, they provided a more comprehensive description of the signs and symptoms of sepsis, covering general clinical parameters and more specific aspects related to inflammation, hemodynamics, organ dysfunction, tissue perfusion, and biochemical markers. Despite these expansions, the core diagnostic criteria for sepsis remained unchanged from the original guidelines.

Sepsis 3 – 2016[25]

- In 2016, an international consensus redefined sepsis and septic shock, leading to updated definitions that emphasized the presence of organ dysfunction due to an abnormal response to infection. This consensus also introduced the qSOFA (quick Sequential Organ Failure Assessment) scoring system, a simplified tool designed to help clinicians quickly identify patients at risk of sepsis by assessing key signs of organ dysfunction, such as altered mental status(GCS score < 15), low blood pressure(Systolic blood pressure <100 mm Hg and increased respiratory rate(>22 breaths/minute).

Sepsis - A life-threatening organ dysfunction caused by dysregulated host response to infection.

Clinical criteria for Sepsis - Suspected or documented infection and an acute increase of ≥ 2 Sequential Organ Failure Assessment (SOFA) points.

- Septic Shock - A subset of sepsis in which underlying circulatory and cellular metabolism abnormalities are profound enough to substantially increase mortality.

Clinical criteria for Septic shock - Sepsis with persisting hypotension, requiring vasopressor therapy to elevate MAP ≥65 mm Hg and lactate >2 mmol/L despite adequate fluid resuscitation.

Table 1: SOFA SCORE[26]

	0	1	2	3	4
Respiration PaO2 /FiO2 (mm Hg)	>400	<400	<300	<200	<100
Coagulation Platelets x $10^3/mm^3$	>150	<150	<100	<50	<20
Liver Bilirubin (mg/dl)	<1.2	1.2- 1.9	2.0-5.9	6.0-11.9	>12.0
Cardiovascular Hypotension	MAP≥70	Map<70	Dopamine ≤5 or (any)	Dopamine >5 norepinephrine ≤0.1	Dopamine >15 norepinephrine > 0.1
Central nervous system Glasgow Coma Score	15	13-14	10-12	6-9	<6
Renal Creatinine(mg/dl) Urine output(ml)	<1.2	1.2-1.9	2.0-3.4	3.5-4.9	>5.0

The Systemic Inflammatory Response Syndrome (SIRS) criteria were still commonly used for screening sepsis but were often criticized for lacking specificity, which resulted in false positives, particularly in patients with non-infectious conditions.[23,27] Due to these limitations, SIRS was excluded from the Sepsis-3 definitions, which introduced the quick Sequential Organ Failure Assessment (qSOFA) score. This new score was intended for both sepsis screening and prognosis.[25] However, qSOFA was found to have limited sensitivity in emergency departments, where patients may not have shown clear signs of organ dysfunction when they first arrived.[28]

Markers of sepsis

To enhance survival rates, early detection of sepsis became a focus for healthcare organizations, leading to extensive research into effective

biomarkers for quick diagnosis and severity evaluation. These biomarkers differed according to the specific mechanisms underlying sepsis. In the 1980s, pro-inflammatory cytokines such as TNF, IL-1β, IL-6, and C-reactive protein (CRP) were identified as significant indicators of the initial hyperinflammatory phase. By the 1990s, CD64 expression was associated with infections, and procalcitonin (PCT) was recognized as a marker for bacterial infections. In 2001, the International Conference on Sepsis officially recognized both CRP and PCT as biomarkers for sepsis.[29]

Complete blood count (CBC) and leukocyte differential (DIFF) tests are also widely used in clinical practice, with their combination frequently applied for sepsis diagnosis.[30] Despite the availability of biomarkers such as lactate, CRP, and PCT, they exhibit limitations, including suboptimal diagnostic accuracy, delayed detection, and/or limited accessibility in clinical settings.[31-32] Consequently, no individual test or biomarker has demonstrated the necessary sensitivity and specificity for the prompt and precise diagnosis of sepsis.[33-34]

Of the various available biomarkers, procalcitonin (PCT) is FDA-approved for assessing the risk of developing sepsis in critically ill patients in the ICU. Nonetheless, PCT has multiple limitations and should be evaluated in conjunction with the clinical context.[35-36] Procalcitonin (PCT) levels can rise nonspecifically in the absence of bacterial infection in various situations, including severe trauma, surgery, cardiogenic shock, birth stress in newborns, heat shock, acute graft-versus-host disease, and certain immunotherapies like granulocyte transfusions or anti lymphocyte globulin and anti-CD3 antibodies. Additionally, autoimmune diseases like Kawasaki disease, vasculitis, and paraneoplastic syndromes may also lead to elevated PCT levels.[6-9]

C-reactive protein (CRP) is an acute-phase protein produced by liver cells and coactivated with the complement system in response to antigens and other stimuli, making it a widely available, cost-effective, and highly sensitive marker of inflammation.[37] While CRP is useful for early disease diagnosis, elevated levels can also occur in viral

infections, cardiovascular diseases, malignancies, tissue injuries, and non-inflammatory conditions, in addition to bacterial infections. In the ICU, slower changes in CRP levels have been linked to ongoing infections, organ failure, and increased mortality.[38]

Microbiological tests are regarded as the "gold standard" for diagnosing infections and are evolving through advancements in molecular technologies, nanotechnology, and microfluidics for point-of-care testing. Nevertheless, 30–50% of sepsis cases are culture-negative. Additionally, while less common, viral or fungal sepsis should also be taken into account during laboratory evaluations in the clinical assessment of sepsis.[39-41]

MONOCYTE DISTRIBUTION WIDTH (MDW)

Elevations in immune cell volume act as early signals of severe infection responses, making them potential biomarkers for sepsis.[10] The monocyte distribution width (MDW) has emerged as a significant biomarker, particularly in acute care settings such as emergency departments and intensive care units. Monocytes play an essential role in inflammation and infection primarily by releasing cytokines.[42] Studies indicate that these cells undergo morphological changes, including volume increases, during inflammatory and infectious processes, particularly in sepsis.[43-46]

These immune effector cells are essential for defending against microbial pathogens and enhancing immune surveillance.[47] Notably, changes in monocytes related to sepsis were first documented in 1993.[15] Their roles include antigen presentation, pathogen phagocytosis, and the production of pro- and anti-inflammatory cytokines.[48] Monocytes in human blood are classified into three subsets based on CD14 and CD16 expression: classical monocytes (CM: CD14++/CD16−), intermediate monocytes (IM: CD14++/CD16+), and non-classical monocytes (NCM: CD14+/CD16++).[49] In inflammatory conditions—such as sepsis,[50] bacterial [51] and viral infections,[52-55] and autoimmune diseases[56] and other anti-inflammatory diseases,[57-58] these subsets exhibit distinct changes in

number, volume, and function. The monocyte distribution width (MDW) has emerged as a quantitative measure of monocyte activation in peripheral blood, serving as an important early indicator of inflammation.[29]

Most studies examining MDW as a diagnostic marker for sepsis have been conducted in adult patients within emergency departments. Notably, three studies focused on adult ICU patients,[59-61] while others were carried out in an adult infectious disease ward,[62] a mixed pediatric inpatient unit,[63] and a neonatal ICU.[64]

MDW as a marker of sepsis in the emergency department

Crouser et al. (2017)[10] conducted a study titled "Improved Early Detection of Sepsis with a Novel Monocyte Distribution Width Biomarker" in the emergency department. This research involved measuring the volume parameters of neutrophils and monocytes in conjunction with routine complete blood count (CBC) testing using a UniCel DxH 800 analyzer at the time of patient admission. A total of 1,320 participants were enrolled and classified into four groups: control subjects (n=879), systemic inflammatory response syndrome (SIRS) (n=203), infection (n=140), and sepsis (n=98). The study found that MDW provided the best differentiation for sepsis compared to other conditions, achieving an area under the curve (AUC) of 0.79, with a sensitivity of 0.77 and a specificity of 0.73, at a threshold of 20.50. When combined with white blood cell (WBC) count, MDW significantly improved detection rates, yielding an AUC of 0.89 compared to 0.81 for WBC count alone ($P < .01$).

Crouser et al. (2019)[14] a blinded, observational, prospective cohort study was conducted to assess the diagnostic accuracy of monocyte distribution width (MDW), both independently and alongside WBC count, for early sepsis detection in the emergency department. This research included 2,158 patients classified according to Sepsis-2 and Sepsis-3 criteria. The findings indicated that MDW values exceeding 20.0 U effectively distinguished sepsis from other conditions based on both criteria. The negative predictive values for MDW ≤ 20.0 U were

found to be 93% for Sepsis-2 and 94% for Sepsis-3. Furthermore, the combination of MDW > 20.0 U with abnormal WBC counts enhanced the detection of Sepsis-2. The study concluded that incorporating MDW into clinical decision-making could enhance the effectiveness of WBC count and SIRS criteria for the early detection of sepsis, as supported by statistical decision curve analyses.

Woo et al. (2021)[65] prospectively enrolled 549 patients to compare monocyte distribution width (MDW) with procalcitonin (PCT) and C-reactive protein (CRP) for early sepsis detection in the emergency department. MDW showed the highest median value (24) in the sepsis group. The study concluded that MDW's diagnostic accuracy was on par with traditional biomarkers, making it a potential alternative. Additionally, combining MDW with the qSOFA score improved the early detection of sepsis.

Hausfater et al. (2021)[66] conducted a blinded prospective cohort study to assess the effectiveness of MDW for sepsis detection in emergency department patients, comparing it with procalcitonin (PCT) and C-reactive protein (CRP). The study included 1,517 patients analyzed according to Sepsis-2 and Sepsis-3 criteria. The results showed that MDW alone achieved an area under the curve (AUC) of 0.81 for diagnosing Sepsis-2, which increased to 0.86 when combined with the white blood cell (WBC) count. For Sepsis-3, MDW attained an AUC of 0.82. In patients with a low pretest probability for sepsis, the combination of MDW and WBC produced an AUC of 0.90, outperforming CRP (0.85) and PCT. The findings indicated that an abnormal MDW significantly raised the odds of Sepsis-2 by 5.5 times and Sepsis-3 by 7.6 times. The study concluded that MDW, particularly when combined with WBC, has strong diagnostic accuracy for sepsis and could enhance screening when used alongside the qSOFA score in the emergency department.

Polilli et al. (2022)[67] conducted an observational prospective monocentric study to evaluate the predictive role of MDW in detecting sepsis among patients in the Emergency Department. Using demographic data, clinical history, and laboratory results, multivariate

logistic regression was applied to predict confirmed sepsis. The study included 2,724 patients, of whom 272 (10%) had sepsis or septic shock. Independent predictors of sepsis included SIRS of 1 (OR: 2.32) and 2 or more (OR: 27.8), MDW >22 (OR: 3.73), smoking (OR: 3.0), end-stage renal disease (OR: 2.3), neurodegenerative disease (OR: 2.2), neutrophils ≥8.9×10³/μL (OR: 2.73), lymphocytes (OR: 1.72), and CRP ≥19.1 mg/L (OR: 2.57). The study concluded that incorporating MDW into routine clinical assessment could enhance early sepsis detection with minimal additional effort.

Malinovska et al. (2022)[68] conducted a prospective cohort study to investigate the diagnostic accuracy of monocyte distribution width (MDW), total white blood cell (WBC) count, and the neutrophil-to-lymphocyte ratio (NLR) for identifying sepsis and septic shock in accordance with Sepsis-3 criteria among 7,952 patients in the emergency department. Out of these, 180 patients were diagnosed with sepsis, including 43 who had septic shock. The results indicated that MDW levels were highest in patients experiencing septic shock (median 24.8 U), followed by those with sepsis without shock (23.9 U), those with infections (20.4 U), and healthy controls (18.6 U). MDW alone achieved an area under the curve (AUC) value of 0.80 for detecting sepsis and 0.85 for septic shock. When combined with WBC count and NLR, MDW improved detection accuracy, resulting in an AUC of 0.86 for both conditions. This study emphasized the significant potential of MDW as an effective screening tool in the emergency department, outperforming conventional markers like qSOFA, WBC count, and NLR when evaluated separately.

M. Encabo et al. (2023)[69] conducted an observational study involving a consecutive prospective cohort of critically ill patients who presented to the Emergency Department with various health issues. The study included 102 participants, with an average age of 76.7 years (SD 16.5), and 53 of them (51.9%) were male. Among these patients, 65 (63.7%) were diagnosed with an infectious disease, while the rest had other medical conditions. The study identified an MDW cut-off value of 20.115, which demonstrated optimal performance for infection

detection, yielding 89.2% sensitivity, 89.2% specificity, a positive predictive value of 93.5%, and a negative predictive value of 82.5%.

Liu et al. (2023)[70] performed a retrospective single-center study to evaluate the effectiveness of Monocyte Distribution Width (MDW) as an early predictor of short-term outcomes in adult patients with sepsis. The study utilized data from the Hospital Information System, analyzing medical records of patients admitted to the emergency department observation unit and intensive care units (ICUs). A total of 252 adult septic patients were included, with MDW levels and traditional inflammatory biomarkers measured at three intervals: day 1, day 3, and day 6 after admission. The outcomes were compared between patients who survived and those who did not after 28 days. The receiver operating characteristic (ROC) curve analysis revealed that MDW levels on day 3 (D3-MDW) had moderate prognostic significance and were independently linked to 28-day mortality. A D3-MDW value of 26.20 effectively differentiated between survivors and non-survivors, showing a sensitivity of 77.8% and a specificity of 67.6%. The study concluded that MDW levels on day 3, along with their changes over time, could serve as important markers for predicting short-term outcomes in adults with sepsis.

MDW as a marker of sepsis in ICU

Elisa Piva et al. (2021)[59] conducted a prospective observational study involving 506 adult patients in the ICU, where they analyzed Monocyte Distribution Width (MDW) in 2,367 daily samples collected from routine complete blood counts (CBC). The study found that patients with sepsis or septic shock exhibited significantly higher MDW values compared to those without sepsis. In patients who developed ICU-acquired sepsis, MDW increased from 21.33 to 29.19, irrespective of the underlying condition, including COVID-19. Among survivors of sepsis, MDW values gradually decreased from a median of 29.14 at the onset of sepsis to 25.67 by the end of their ICU stay.

Polilli et al. (2021)[60] performed a prospective observational study at a single center, which included 211 ICU patients, ultimately narrowing

the focus to 129 individuals. Out of these, 74 patients (57%) were confirmed to have sepsis. The results showed that MDW values above 23 were strongly linked with a high positive predictive value (PPV) for sepsis, whereas values at or below 20 indicated a high negative predictive value (NPV).

Agnello et al. (2021)[61] included 2,297 patients in their study, with 82 admitted to the ICU and 2,215 presenting to the emergency department (ED). The optimal MDW cutoff for detecting sepsis among ICU patients, determined using Youden's index, was 23.9, with a sensitivity of 95.7% and specificity of 79.7% at this threshold. For emergency department patients, the best cutoff for MDW was 23.5, yielding a sensitivity of 90.9% and specificity of 92.9%. Receiver operating characteristic (ROC) curve analysis showed that the AUC for predicting sepsis using MDW was 0.964 in the emergency department population and 0.937 among ICU patients.

Polilli et al. (2020)[62] conducted a prospective observational study to evaluate the effectiveness of Monocyte Distribution Width (MDW) in identifying sepsis, comparing it with Procalcitonin (PCT). The study included 266 patients, of whom 105 (40.4%) were diagnosed with sepsis. Multivariate analysis revealed that both MDW (OR: 1.57) as a continuous variable and PCT levels exceeding 1 ng/mL (OR: 48.5) were independently associated with sepsis. The study identified optimal cutoff values of 22.0 for MDW and 1.0 ng/mL for PCT for detecting sepsis. Notably, MDW values under 20 were frequently correlated with negative blood cultures. Receiver operating characteristic (ROC) curve analysis indicated that the area under the curve (AUC) for MDW was 0.87, closely aligning with PCT's AUC of 0.88. The findings suggested that integrating MDW into routine white blood cell (WBC) counts could significantly enhance sepsis detection.

Malinovska et al. (2023)[71] conducted a systematic review and meta-analysis encompassing 29 studies, with 19 focused on sepsis and 6 on COVID-19. The study evaluated the diagnostic performance of monocyte distribution width (MDW) and found that its effectiveness varied depending on the reference standard used for diagnosing sepsis

(whether following the Second or Third International Consensus Definitions for Sepsis and Septic Shock) and the type of anticoagulant used in the collection tubes. The area under the receiver operating characteristic curve (AUC) for sepsis was reported to range from 0.74 to 0.94, with sensitivity levels between 0.69 and 0.79, and specificity rates from 0.57 to 0.86. In the context of COVID-19, the pooled AUC was found to be 0.76, exhibiting a sensitivity of 0.79 and a specificity of 0.59. The authors concluded that MDW displayed strong diagnostic capabilities for both sepsis and COVID-19.

MATERIAL AND METHODS

SOURCE OF DATA:

Study design–Observational study

Study place- ICU, Dayanand medical college and hospital, Ludhiana

Sample size – 100

METHOD OF COLLECTION OF DATA

INCLUSION CRITERIA-

- Patients over 18 years of age who were admitted to the ICU.
- Patients with suspected sepsis as per Sepsis Consensus 3 criteria

EXCLUSION CRITERIA-

- Patients with < 48 hours stay in ICU
- Patients with hematological disorders
- Patients on steroids
- Patients with bone marrow and solid organ transplant
- Patients with hereditary immune deficiencies
- Patients with HIV
- Patients with a history of burns
- Patients with a history of CKD, CLD
- Pregnant patients

STUDY PROTOCOL: This study included 100 patients with suspected sepsis during their stay in the ICU who fulfilled the inclusion criteria after obtaining informed consent from the patient or legal representative as appropriate. These patients were divided into two groups one with confirmed sepsis and the other with probable infection based on sepsis 3 criteria.

As per the sepsis 3 criteria- The description of each group was as follows:

Group (1) infection (confirmed sepsis), patients with evidence of infection (positive blood culture or serology test) and

Group (2) sepsis (probable infection), patients with evidence of infection with the SOFA score being higher than two points, according to the Sepsis-3 criteria.

To exclude patients with a short-term ICU stay (less than 48 hours), individuals were enrolled consecutively after completing 48 hours in the ICU. Patient demographic and clinical details, along with past medical history and laboratory parameters, were recorded. Total leukocyte count and MDW levels were analyzed on the first day of enrollment and then monitored daily for a week. MDW values were excluded from medical reports as they were collected solely for research purposes and later used for statistical analysis. Blood cultures and other diagnostic tests, including biomarkers, were performed based on the physician's clinical suspicion of infection. MDW measurements were taken from a K3EDTA whole-blood venous sample and analyzed within two hours, using the same blood sample used for CBC tests. During the study, our focus was on analyzing patients with suspected sepsis during their ICU stay and comparing them with those who had a confirmed sepsis diagnosis based on established definitions.

OUTCOME

Early identification of sepsis using monocyte distribution width in ICU.

STATISTICAL ANALYSIS

Sample Size Calculation

The incidence of sepsis in the ICU was estimated to be between 8% and 10%.[60]

Assumptions:

Confidence Level = 95%

Precision (d) = ± 6%

The sample size was determined using the formula:

$n = (Z2\alpha \times P \times (1-P))/d2$

Where;

$Z\alpha$ = Value of standard normal variate corresponding to α level of significance

P = Likely value of parameter (10%)

Q = 1 – P

d = Margin of errors which is a measure of precision

With these parameters, the sample size was calculated to be 96 participants.

Data were presented as ranges, means ± standard deviation (SD), medians with interquartile ranges (IQR), frequencies (number of cases), and percentages as appropriate. The Mann-Whitney U test was utilized to compare quantitative variables between the groups. For categorical data, the Chi-square (χ^2) test was applied, and Fisher's exact test was used when expected frequencies were fewer than five. Receiver operating characteristic (ROC) curve analysis was performed to determine the criterion value based on sensitivity and specificity, with the area under the curve (AUC) also calculated. A p-value of less than 0.05 was considered statistically significant. All analyses were conducted using SPSS version 21.0 (SPSS Inc., Chicago, IL, USA) for Microsoft Windows.

OBSERVATIONS AND RESULTS

A total of 100 patients with a suspected diagnosis of sepsis, in accordance with the definitions outlined by the Third International Consensus on Sepsis and Septic Shock, were included in the study. Based on positive blood culture, endotracheal culture, urine culture, abdominal drain culture, or positive serology (fungal biomarkers or tropical fever profile), septic patients were divided into confirmed sepsis and probable sepsis. Confirmed sepsis was identified in 52% of patients, while 48% were classified as having probable sepsis.

TABLE 2: DISTRIBUTION OF PATIENTS BY AGE

AGE GROUP	CONFIRMED SEPSIS		PROBABLE SEPSIS		Total		Chi-square value	p-value
	NO	%age	NO	%age	No. of cases	%age		
< 30	8	15.4%	7	14.6%	15	15.0%	3.123	0.54
31-40	10	19.2%	13	27.1%	23	23.0%		
41-50	12	23.1%	9	18.8%	21	21.0%		
51-60	10	19.2%	13	27.1%	23	23.0%		
> 60	12	23.1%	6	12.5%	18	18.0%		
TOTAL	52	100.0%	48	100.0%	100	100.0%		

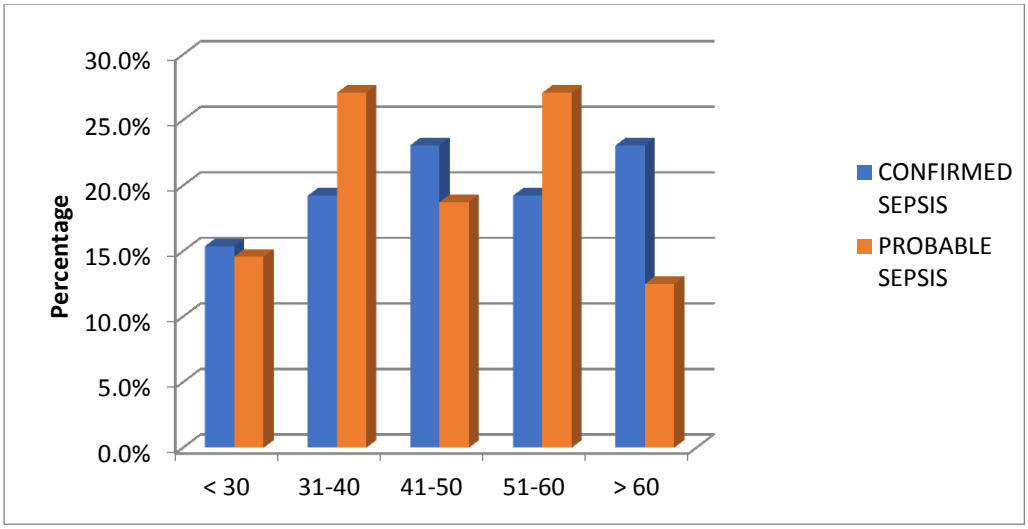

FIGURE 2: DISTRIBUTION OF PATIENTS BY AGE

TABLE 3: MEAN AGE OF GROUPS

	CONFIRMED SEPSIS		PROBABLE SEPSIS		t	p-value
	Mean	SD	Mean	SD		
AGE (years)	48.21	15.70	46.67	13.67	-0.626	0.532

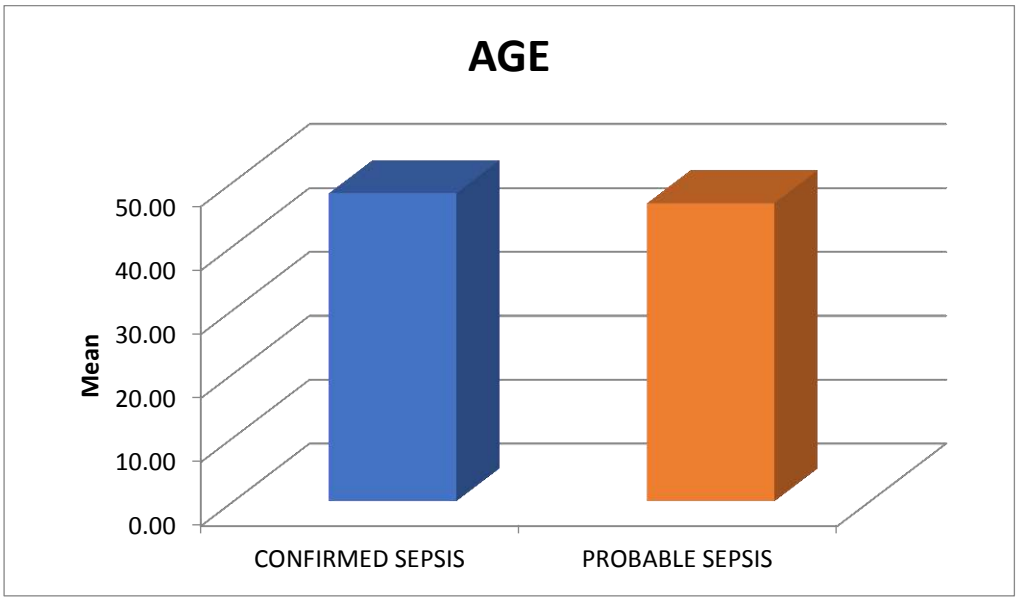

FIGURE 3: MEAN AGE OF GROUPS

The study analyzed the distribution of sepsis cases across different age groups in an ICU setting. The data was categorized into confirmed sepsis and probable sepsis cases, with a total of 100 cases.

Out of 52 patients in confirmed sepsis group, 15.4% (n= 8) patients belonged to the age group below 30 years., 19.2 % (n= 10) belonged to the age group of 31 – 40 yrs, 23.1 % (n= 12) belonged to 41 – 50 yrs, 19.2 % (n= 10) belonged to 51 – 60 yrs and 23.1 % (n= 12) belonged to > 60 yrs. The mean age of this group was 48.21 ± 15.70

Out of 48 patients in the probable sepsis group, 14.6% (n= 7) of patients belonged to the age group below 30 years. 27.1 % (n= 13) belonged to the age group of 31 – 40 yrs, 18.8 % (n= 9) belonged to 41 – 50 yrs, 27.1 % (n= 13) belonged to 51 – 60 yrs and 12.5% (n= 6) belonged to > 60 yrs. The mean age of this group was 46.67 ± 13.67.

The age distribution across the two groups showed no significant statistical difference (p = 0.54).

TABLE 4: GENDER DISTRIBUTION AMONG GROUPS

GENDER	CONFIRMED SEPSIS		PROBABLE SEPSIS		Total		Chi-square value	p-value
	NO	%age	No	%age	No. of cases	%age		
Female	19	36.5%	18	37.5%	37	37.0%	0.01	0.92
male	33	63.5%	30	62.5%	63	63.0%		
TOTAL	52	100.0%	48	100.0%	100	100.0%		

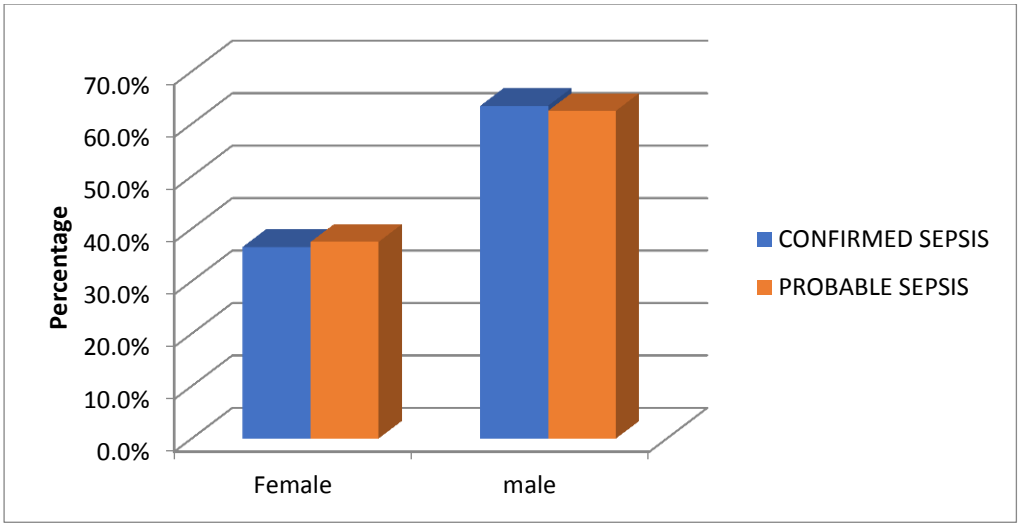

FIGURE 4: GENDER DISTRIBUTION AMONG GROUPS

Out of 52 patients in the confirmed sepsis group 19 were females and 33 were males whereas in the probable sepsis group 18 were females and 30 were males. The gender distribution did not show a significant difference between the two groups (p = 0.92). The confirmed sepsis group had a male-to-female ratio of 1.73, whereas the probable sepsis group had a ratio of 1.66.

TABLE 5: DISTRIBUTION OF COMORBIDITIES BETWEEN THE TWO GROUPS

COMORBIDITIES	CONFIRMED SEPSIS		PROBABLE SEPSIS		Total		Chi-square value	p-value
	No	%age	No	%age	No. of cases	%age		
HTN	14	26.9%	15	31.3%	29	29.0%	0.227	0.63
DM	15	28.8%	10	20.8%	25	25.0%	0.855	0.36
HYPOTHYROID	3	5.8%	1	2.1%	4	4.0%	0.883	0.35
CAD	3	5.8%	3	6.3%	6	6.0%	0.01	0.92
COPD	6	11.5%	0	0.0%	6	6.0%	5.892	0.02

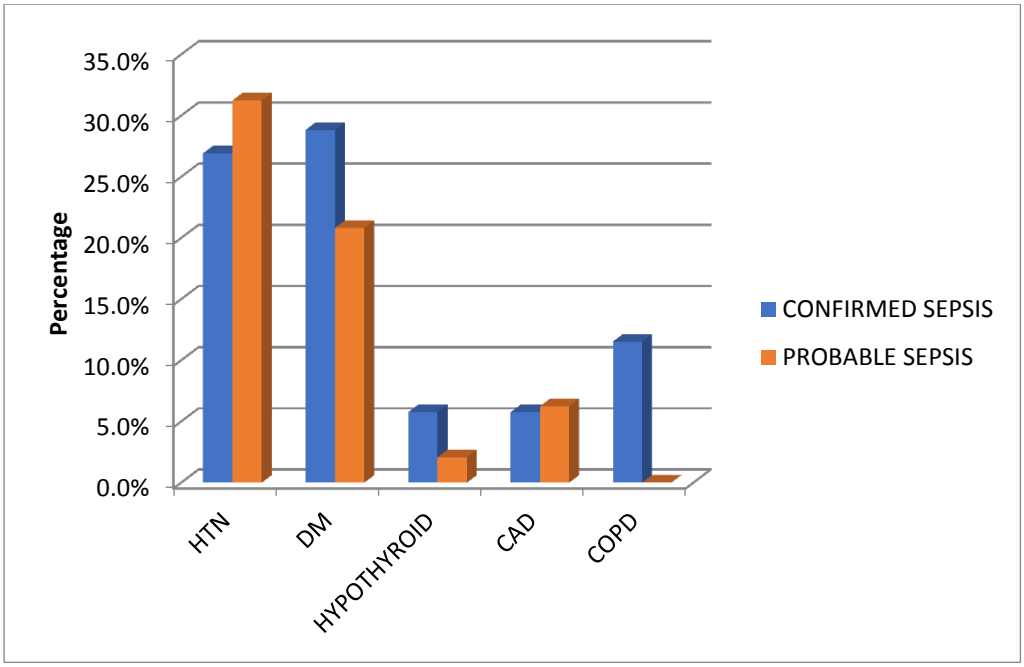

FIGURE 5: DISTRIBUTION OF COMORBIDITIES BETWEEN THE TWO GROUPS

A statistically insignificant difference was seen between the two groups when the groups were compared based on the presence of a history of HTN, Diabetes, Hypothyroidism, and CAD except for COPD (p value= 0.02)

TABLE 6: SOURCES OF INFECTION

SOURCE	CONFIRMED SEPSIS		PROBABLE SEPSIS		Total		Chi-square value	P value
	No. of cases	%age	No. of cases	%age	No. of cases	%age		
ABDOMEN	22	42.3%	26	54.2%	48	48.0%	12.587	0.05
BLOOD	4	7.7%	3	6.3%	7	7.0%		
BRAIN	5	9.6%	8	16.7%	13	13.0%		
BRAIN INJURY	0	0.0%	1	2.1%	1	1.0%		
LUNG	8	15.4%	9	18.8%	17	17.0%		
SSI	6	11.5%	0	0.0%	6	6.0%		
URINARY TRACT	7	13.5%	1	2.1%	8	8.0%		
TOTAL	52	100%	48	100%	100	100%		

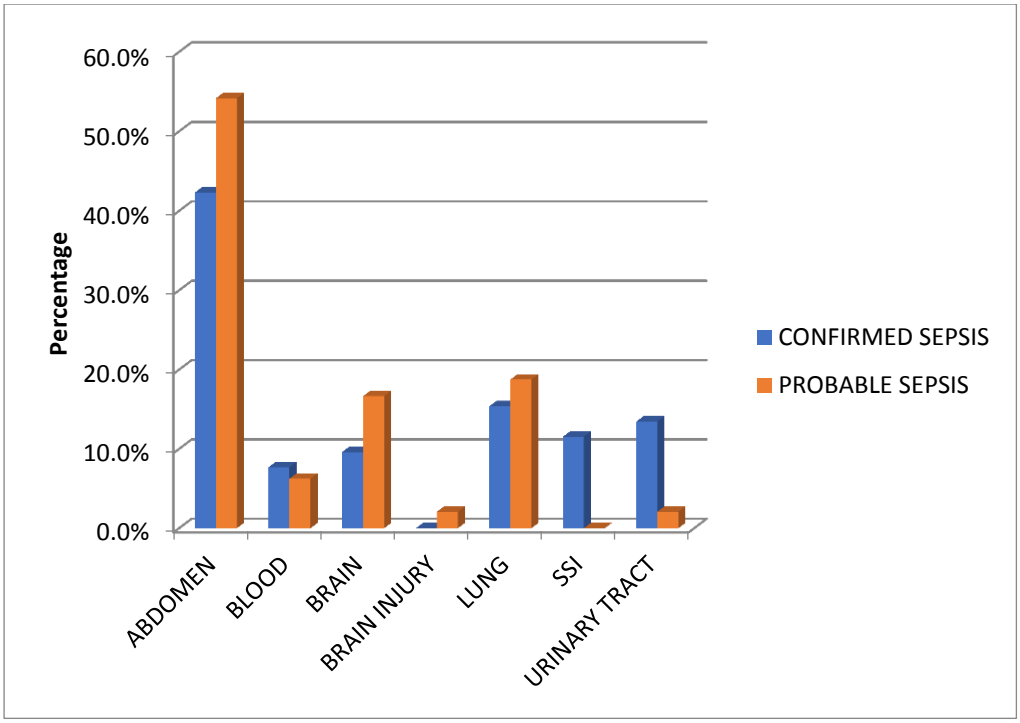

FIGURE 6: SOURCES OF INFECTION

The comparison of the two groups based on the source of sepsis revealed a statistically significant difference (p = 0.05).

TABLE 7: REQUIREMENT OF MECHANICAL VENTILATION

		CONFIRMED SEPSIS		PROBABLE SEPSIS		Total		Chi-square value	p-value
		No	% age	No	% age	No	% age		
MECHANICAL VENTILATION	yes	37	71.2%	27	56.3%	64	64.0%	2.4	0.15
	no	15	28.8%	21	43.8%	36	36.0%		
Total		52	100.0%	48	100.0%	100	100.0%		

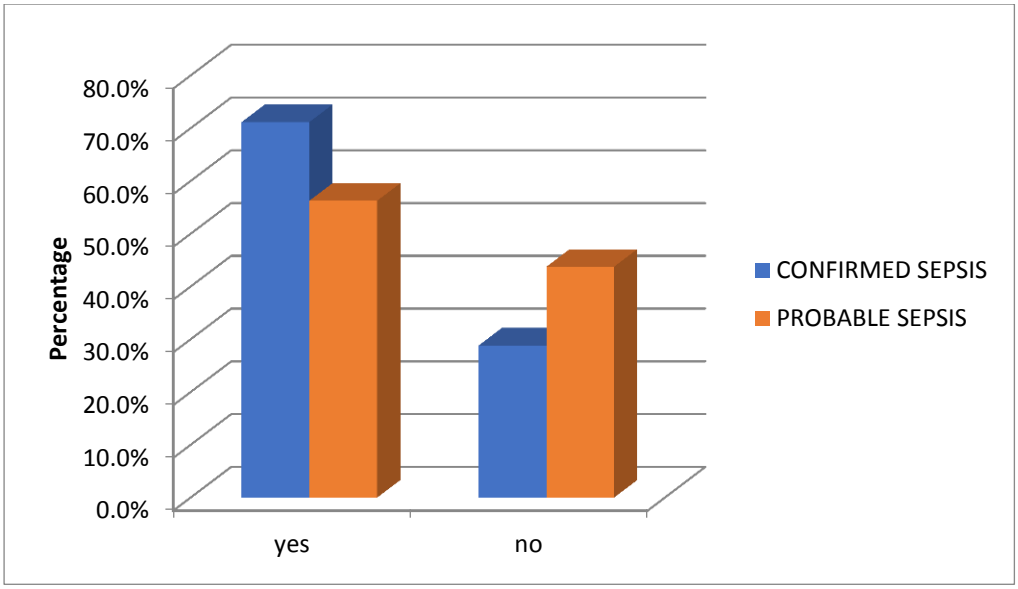

FIGURE 7: REQUIREMENT OF MECHANICAL VENTILATION

Mechanical ventilation was required for 71.2% (n = 37) of patients in the confirmed sepsis group, compared to 56.3% (n = 27) in the probable sepsis group; however, the difference was not statistically significant (p = 0.15).

TABLE 8: REQUIREMENT OF VASOPRESSOR SUPPORT

		CONFIRMED SEPSIS		PROBABLE SEPSIS		Total		Chi-square value	p-value
		No	%age	No	%age	No	%age		
VASOPRESSOR SUPPORT	yes	34	65.4%	19	39.6%	53	53.0%	6.7	0.02
	no	18	34.6%	29	60.4%	47	47.0%		
Total		52	100.0%	48	100.0%	100	100.0%		

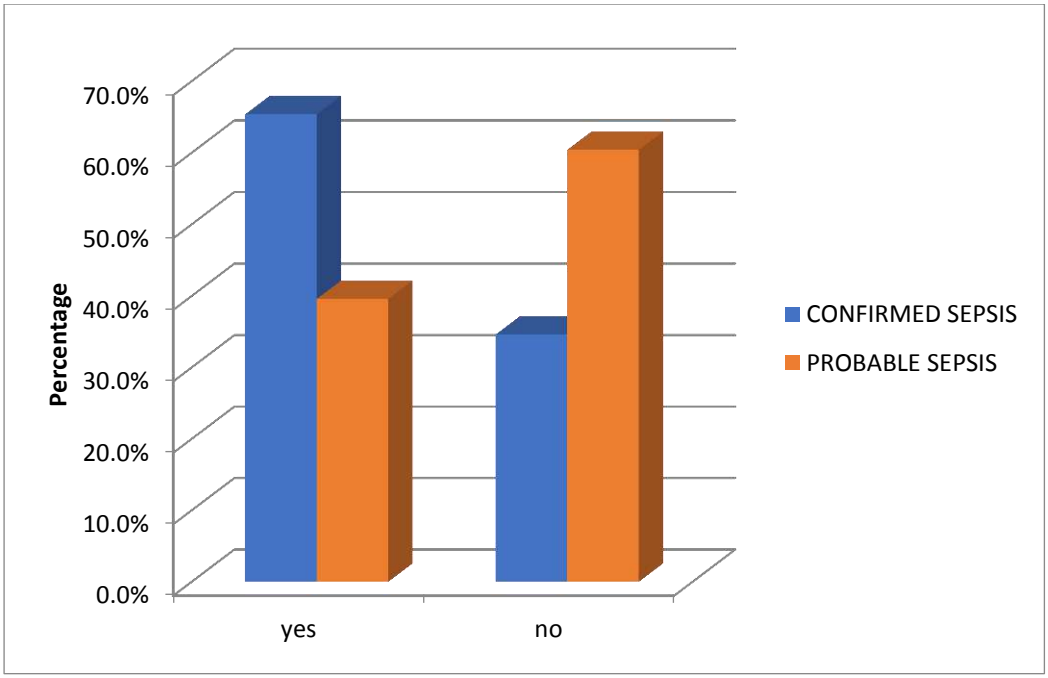

FIGURE 8: REQUIREMENT OF VASOPRESSOR SUPPORT

The need for vasopressor support was noted in 65.4% (n = 34) of patients in the confirmed sepsis group, compared to 39.6% (n = 19) in the probable sepsis group, indicating a statistically significant difference (p = 0.02).

TABLE 9: BASELINE VARIABLES AMONG THE TWO GROUPS

	CONFIRMED SEPSIS				PROBABLE SEPSIS				Z	P VALUE
	Mean	SD	Median	IQR	Mean	SD	Median	IQR		
HR(b/m)	103.00	18.44	100.00	92.25-110	104.56	15.36	100.00	98-112.25	-0.502	0.615
SBP(mmHg)	113.85	13.80	110.00	106.5-119.5	120.67	14.13	122.00	110-130	-2.433	0.015
DBP(mmHg)	64.96	8.50	64.00	60-70	67.79	9.50	68.00	62.5-70	-1.673	0.094
SPO2	96.52	3.64	98.00	96-98	97.56	2.28	98.00	97-99.75	-1.390	0.165
RR(breaths/min)	19.19	3.66	20.00	16-20	18.40	5.27	18.00	16-20	-1.770	0.077

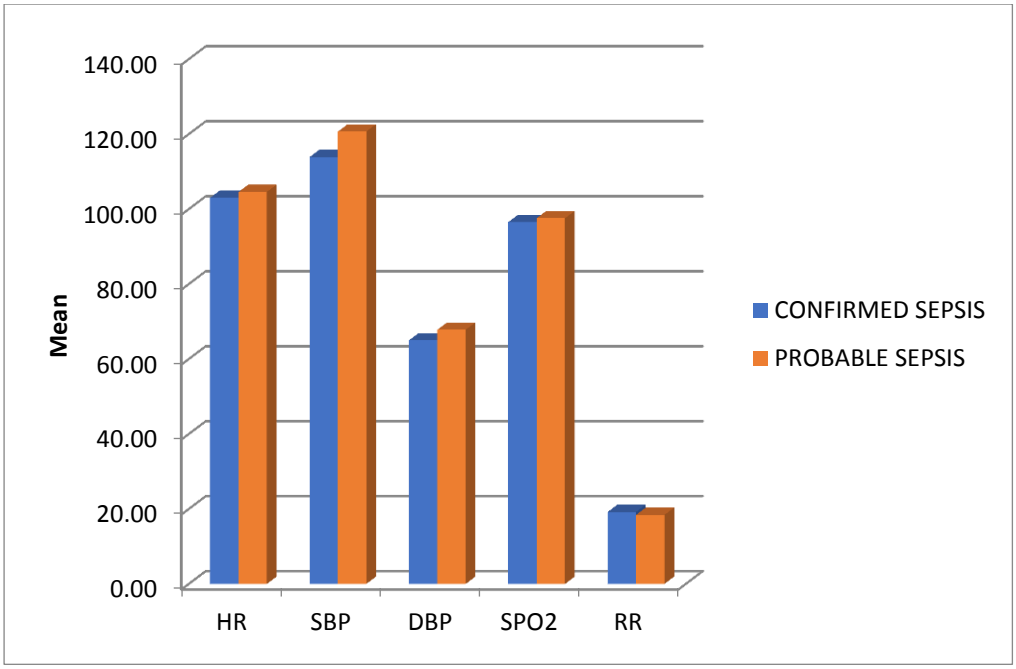

FIGURE 9: BASELINE VARIABLES AMONG THE TWO GROUPS

There were no statistically significant differences in baseline parameters between the two groups, with the sole exception of systolic blood pressure (SBP). Patients with confirmed sepsis had a significantly lower mean SBP (113.85 mmHg) compared to those with probable sepsis (120.67 mmHg), with a p-value of 0.015.

TABLE 10: COMPARISON BASED ON ADMISSION GCS, TEMPERATURE, SOFA (SEQUENTIAL ORGAN FAILURE ASSESSMENT SCORE) BETWEEN THE TWO GROUPS

	CONFIRMED SEPSIS				PROBABLE SEPSIS				Z	P VALUE
	Mean	SD	Median	IQR	Mean	SD	Median	IQR		
GCS	10.06	3.52	10.00	8-13.75	11.92	3.08	11.00	9-15	-2.634	0.008
TEMPERATURE (°F)	99.63	1.71	100.00	98.475-101	98.85	1.24	99.00	98-100	-2.888	0.004
SOFA	6.69	3.09	6.00	4-8.75	5.19	1.88	5.00	4-7	-2.122	0.034

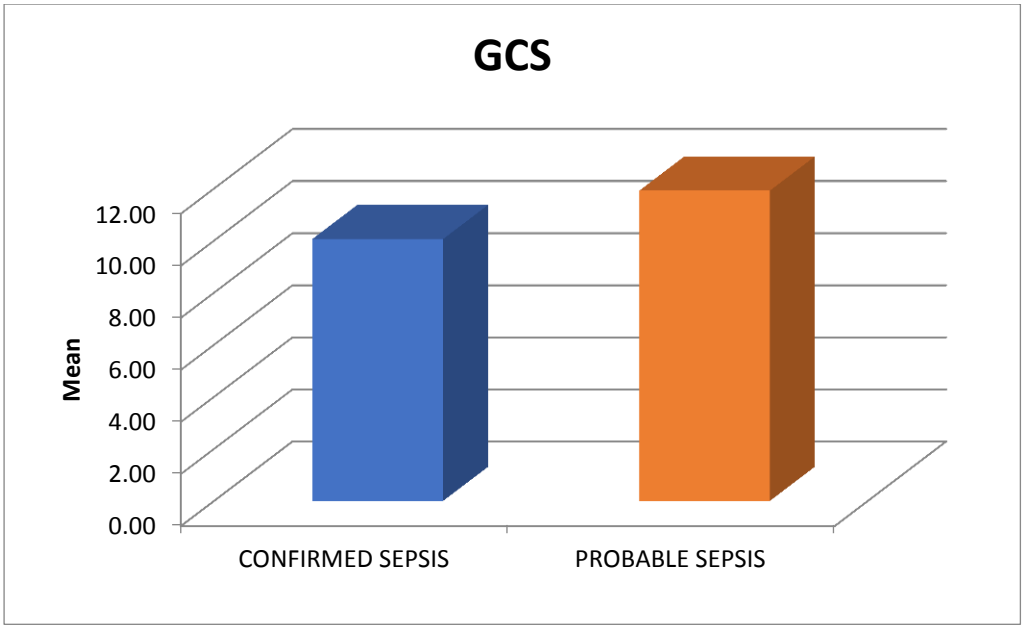

FIGURE 10: COMPARISON BASED ON ADMISSION GCS BETWEEN THE TWO GROUPS

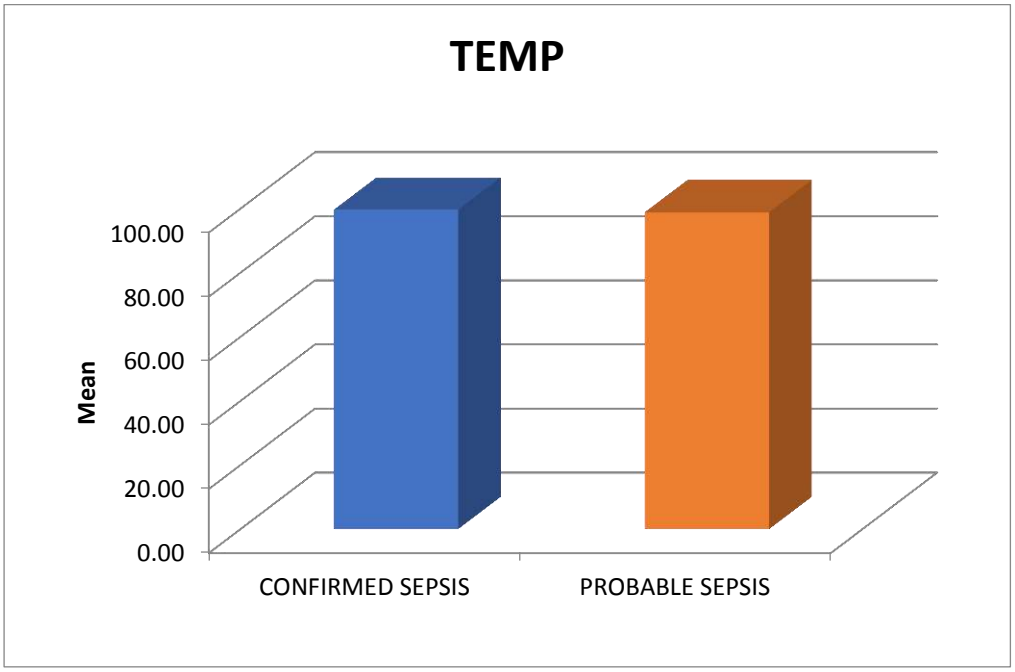

FIGURE 11: COMPARISON BASED ON ADMISSION TEMPERATURE BETWEEN THE TWO GROUPS

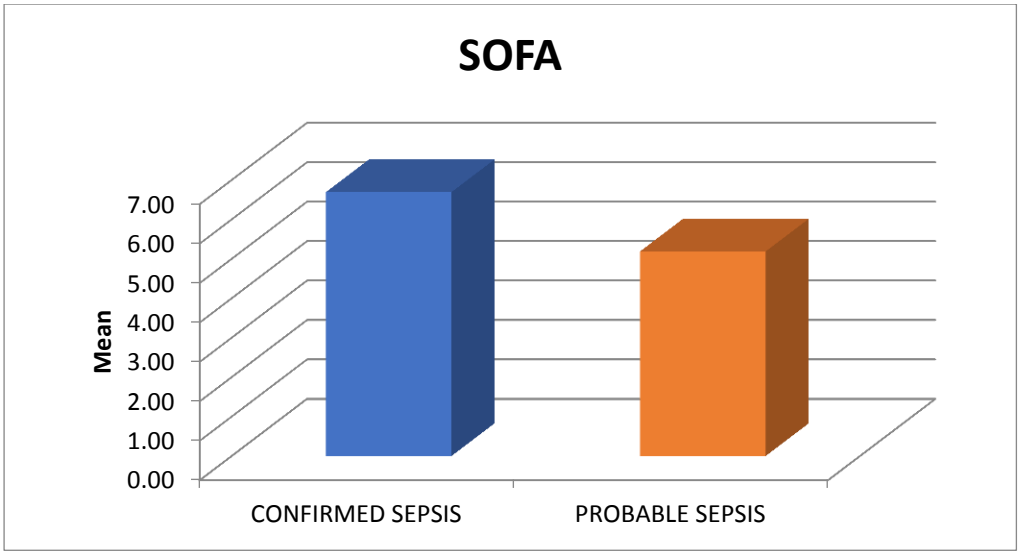

FIGURE 12: COMPARISON BASED ON ADMISSION SOFA BETWEEN THE TWO GROUPS

A statistically significant difference was noted between the two groups when groups were compared based on clinical parameters i.e., GCS (p value= 0.008), temperature (p value= 0.004), and SOFA (p value= 0.034).

TABLE 11: COMPARISON BASED ON ADMISSION LACTATE BETWEEN THE TWO GROUPS

	CONFIRMED SEPSIS				PROBABLE SEPSIS				Z	P VALUE
	Mean	SD	Median	IQR	Mean	SD	Median	IQR		
LACTATE	3.03	1.97	2.35	1.7-4.375	3.02	2.39	2.25	1.2-4.375	-0.432	0.666

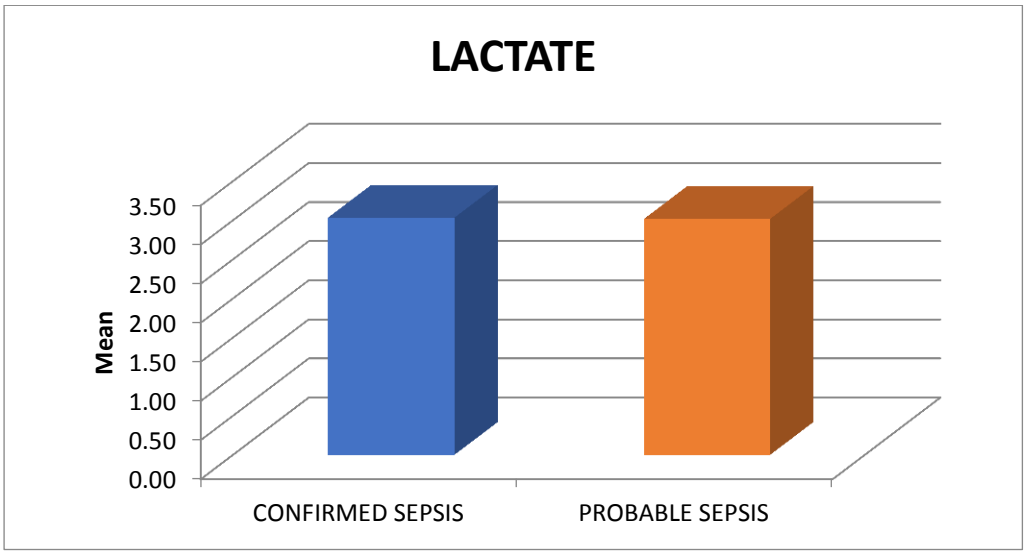

FIGURE 13: COMPARISON BASED ON ADMISSION LACTATE BETWEEN THE TWO GROUPS

On admission, lactate levels did not demonstrate a statistically significant difference between the confirmed sepsis group (mean = 3.03 ± 1.97) and the probable sepsis group (mean = 3.02 ± 2.39).

TABLE 12: COMPARISON BASED ON THE DURATION OF MECHANICAL VENTILATION BETWEEN THE TWO GROUPS

	CONFIRMED SEPSIS				PROBABLE SEPSIS				Z	P VALUE
	Mean	SD	Median	IQR	Mean	SD	Median	IQR		
DURATION OF MECHANICAL VENTILATION(DAYS)	7.27	5.16	6.00	3-9.5	3.07	2.20	2.00	2-4	-4.242	0.001

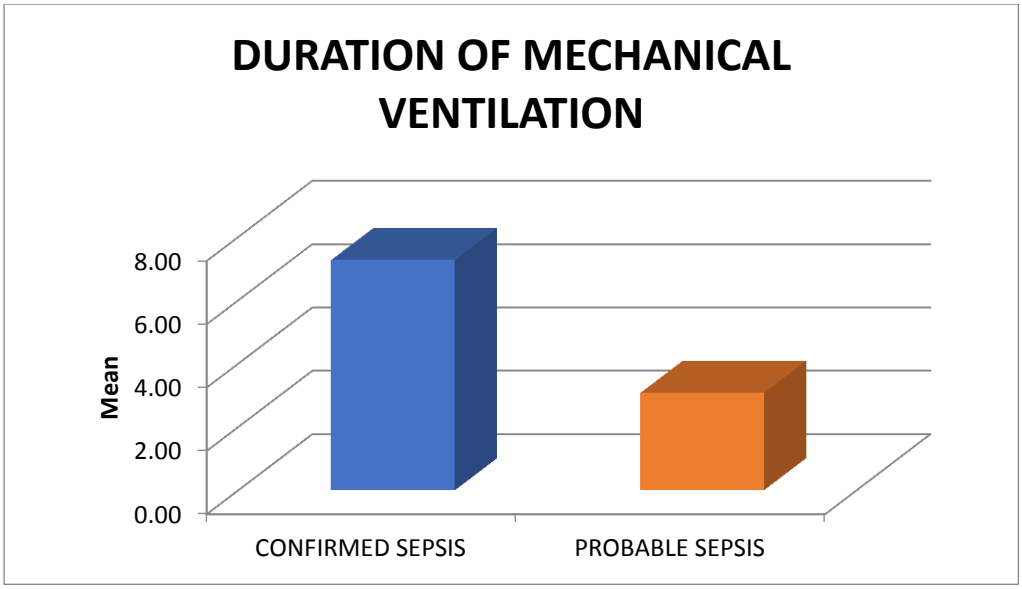

FIGURE 14: COMPARISON BASED ON THE DURATION OF MECHANICAL VENTILATION BETWEEN THE TWO GROUPS

Duration of Mechanical Ventilation was significantly longer in patients with confirmed sepsis (mean 7.27±5.16 days) compared to those with probable sepsis (mean = 3.07±2.20 days), with a p-value of 0.001.

TABLE 13: DURATION OF ANTIBIOTIC USE BETWEEN THE TWO GROUPS

	CONFIRMED SEPSIS				PROBABLE SEPSIS				Z	P VALUE
	Mean	SD	Median	IQR	Mean	SD	Median	IQR		
DURATION OF ANTIBIOTICS(DAYS)	20.58	6.88	21.00	14.25-25	15.17	5.05	14.00	12-18	-4.303	0.001

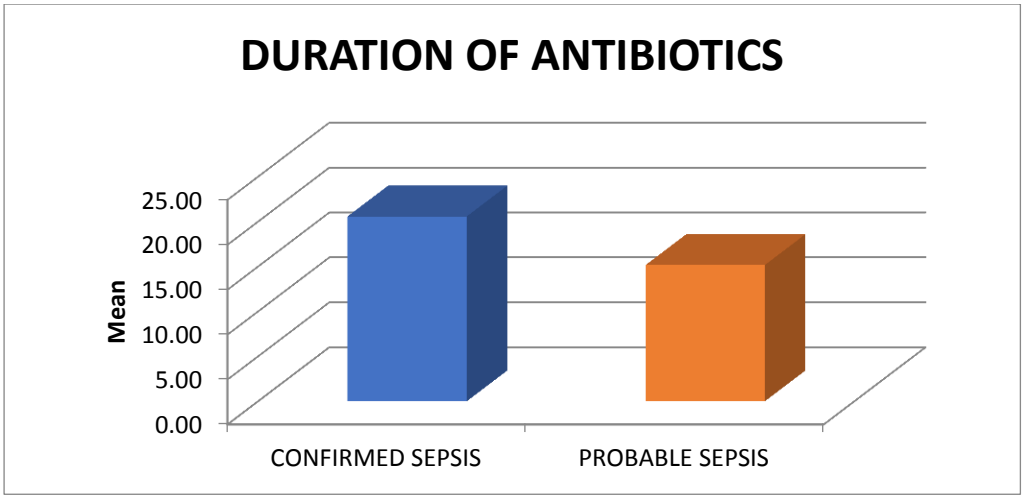

FIGURE 15: DURATION OF ANTIBIOTIC USE BETWEEN THE TWO GROUPS

The mean duration of mechanical ventilation for patients with confirmed sepsis was 7.27 days, with a median of 6.00 days. For patients with probable sepsis, the mean duration was 3.07 days with a median of 2.00 days. The Z value was -4.242, with a p-value of 0.001, indicating a statistically significant difference in the duration of mechanical ventilation between the two groups.

TABLE 14: COMPARISON OF ICU STAY DURATION BETWEEN THE TWO GROUPS

	CONFIRMED SEPSIS				PROBABLE SEPSIS				Z	P VALUE
	Mean	SD	Median	IQR	Mean	SD	Median	IQR		
LENGTH OF ICU STAY(DAYS)	12.19	5.42	10.00	8-15.75	8.35	3.48	7.00	6-10	-4.248	0.001

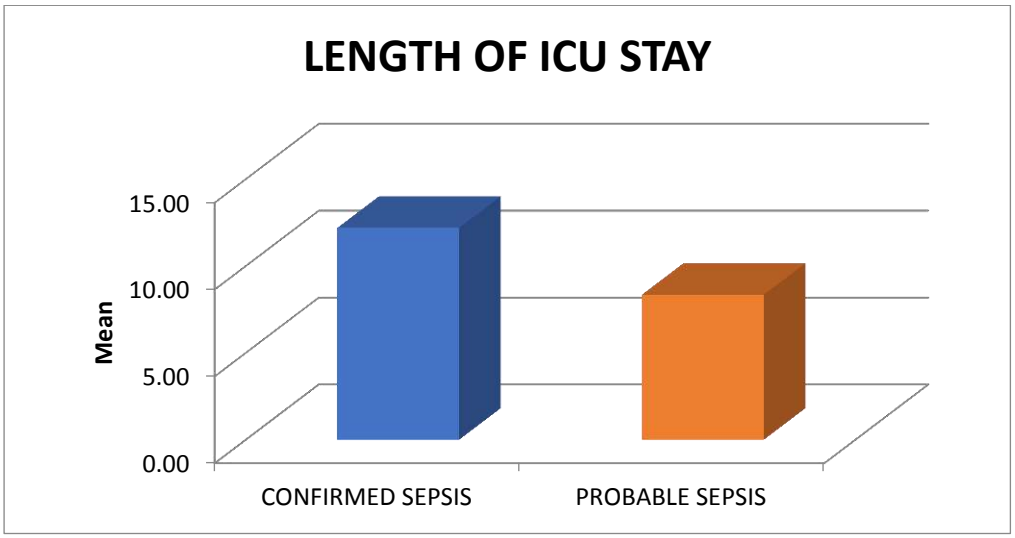

FIGURE 16: COMPARISON OF ICU STAY DURATION BETWEEN THE TWO GROUPS

A statistically significant difference was noted in the duration of ICU stay between the two groups (p = 0.001).

TABLE 15: COMPARISON BASED ON ICU MORTALITY BETWEEN THE TWO GROUPS

ICU MORTALITY	CONFIRMED SEPSIS		PROBABLE SEPSIS		Total		Chi-square value	p-value
	No	%age	No	%age	No	%age		
DEATH	10	19.2%	2	4.2%	12	12.0%	5.310	0.021
SURVIVOR	42	80.7%	46	95.8%	88	88%		
Total	52	100.0%	48	100.0%	100	100.0%		

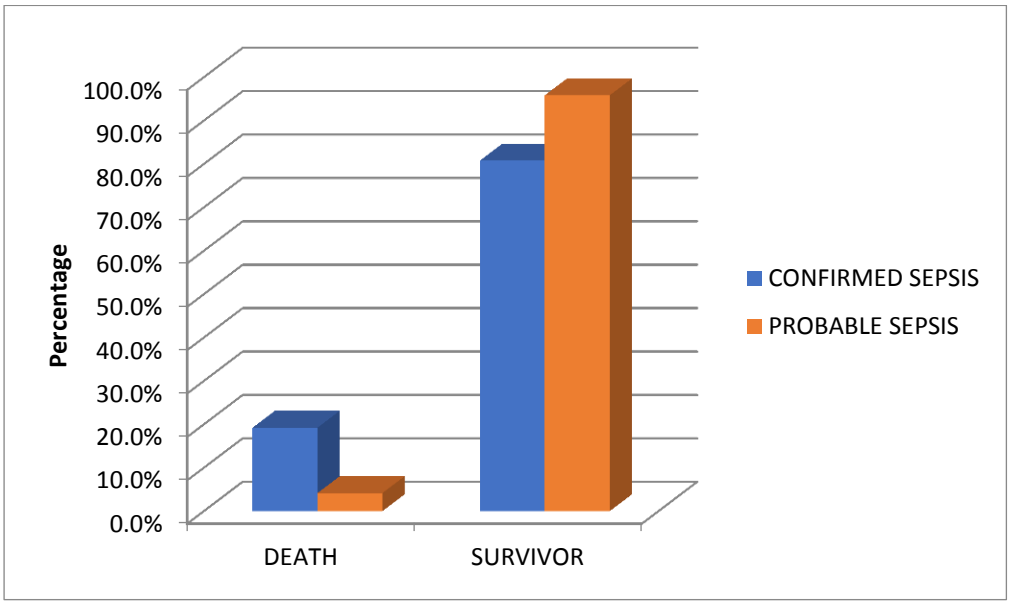

FIGURE 17: COMPARISON BASED ON ICU MORTALITY BETWEEN THE TWO GROUPS

In the confirmed sepsis group, 19.2% (n = 10) of patients died, compared to 4.2% (n = 2) in the probable sepsis group, with this difference being statistically significant (p = 0.021).

TABLE 16: COMPARISON OF TLC VALUES BETWEEN THE TWO GROUPS FROM DAY 1 TO DAY 7

	CONFIRMED SEPSIS				PROBABLE SEPSIS				Z	P VALUE
TLC ($\times 10^3/mm^3$)	Mean	SD	Median	IQR	Mean	SD	Median	IQR		
DAY 1 TLC	19.03	9.27	20.55	12.1-24.6575	15.77	7.61	14.25	11.1-17.885	-2.615	0.009
DAY2 TLC	20.37	8.65	22.20	14.975-26.525	17.19	9.19	15.55	12.36-19.85	-2.884	0.004
DAY3 TLC	20.16	8.44	21.40	15.325-26	16.25	6.68	14.95	12.60-20.1	-3.074	0.002
DAY4 TLC	18.83	7.34	19.05	13.8475-23.6525	14.14	5.78	11.45	10.27-19	-3.543	0.000
DAY5 TLC	18.03	6.82	18.25	13.55-21.5325	12.36	5.35	10.20	7.9-17.8	-4.040	0.000
DAY6 TLC	17.96	6.69	17.50	14.025-20.525	10.65	4.41	8.60	7-14	-5.632	0.000
DAY7 TLC	17.35	7.73	16.00	12.175-20.1	9.38	4.22	7.40	6.1-12	-5.731	0.000
TLC	18.82	6.34	19.93	14.68-22.39	14.17	7.25	11.30	9.9-17.93	-4.312	0.000

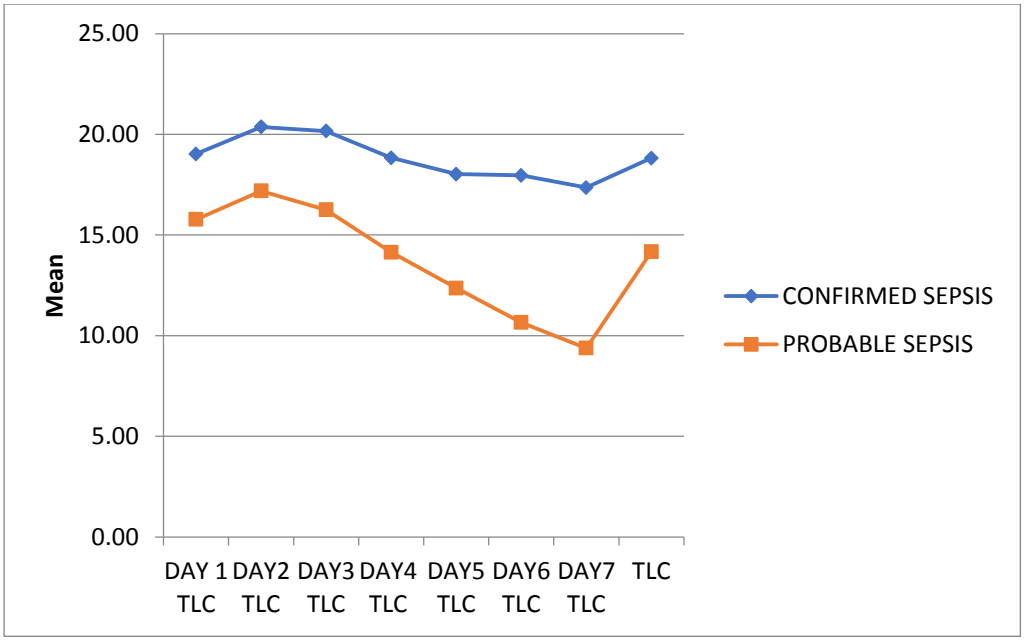

FIGURE 18: COMPARISON OF TLC VALUES BETWEEN THE TWO GROUPS FROM DAY 1 TO DAY 7

The values of total leukocyte count (TLC) over seven days revealed significant differences between patients with confirmed and probable sepsis (p value= 0.000).

TABLE 17: COMPARISON OF NL RATIO VALUES BETWEEN THE TWO GROUPS FROM DAY 1 TO DAY 7

	CONFIRMED SEPSIS				PROBABLE SEPSIS				Z	P VALUE
	Mean	SD	Median	IQR	Mean	SD	Median	IQR		
DAY 1 NL RATIO	12.00	7.34	10.16	6.5-15.975	8.65	6.14	6.70	4.5-10.875	-2.610	0.009
DAY2 NL RATIO	13.46	7.51	11.45	8.75-17.61	10.16	6.94	8.00	5.925-11.75	-2.899	0.004
DAY3 NL RATIO	14.96	9.35	14.00	9.1975-18.85	9.55	5.96	8.05	4.625-12.25	-3.391	0.001
DAY4 NL RATIO	13.49	8.57	12.05	7.425-16.775	8.05	4.90	7.60	4.3-10.1	-3.756	0.001
DAY5 NL RATIO	11.48	7.12	10.05	6.475-15.75	7.57	5.59	6.51	3.4-9.8	-3.353	0.001
DAY6 NL RATIO	10.32	6.87	8.80	4.825-13.85	5.81	4.11	4.40	3-8.3	-4.100	0.001
DAY 7 NL RATIO	9.15	6.70	7.35	4.125-11	4.89	3.69	3.70	2.7-4.8	-4.430	0.001
NL RATIO	12.12	5.74	11.69	7.93-15.683	8.13	5.52	6.51	4.63-9.75	-4.043	0.001

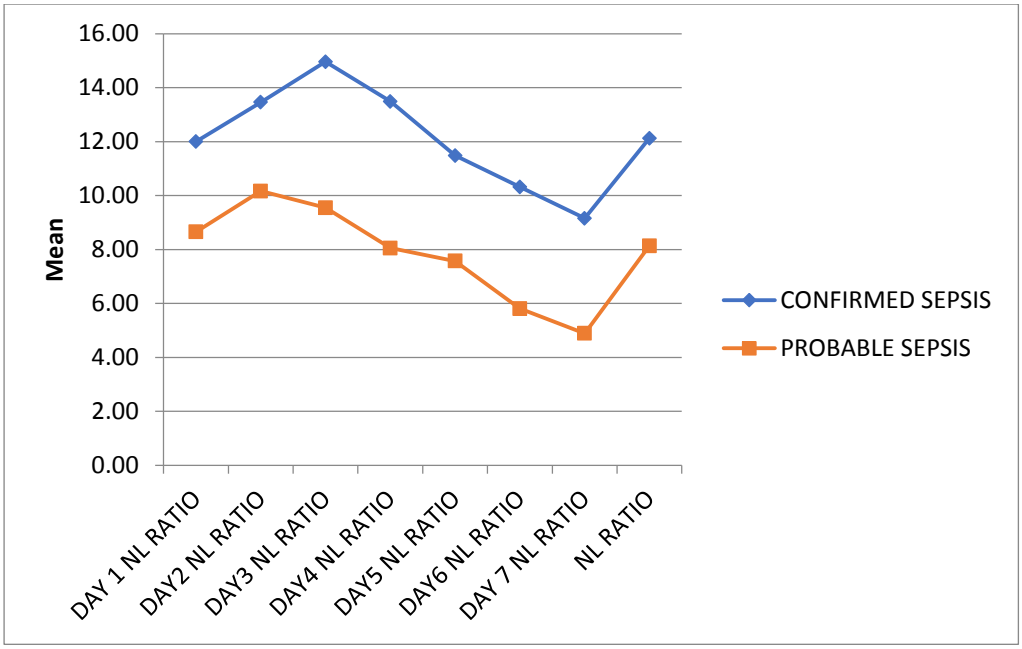

FIGURE 19: COMPARISON OF NL RATIO VALUES BETWEEN THE TWO GROUPS FROM DAY 1 TO DAY 7

The analysis of the neutrophil-to-lymphocyte ratio (NLR) over seven days demonstrated significant differences between patients with confirmed sepsis and those with probable sepsis (p value= 0.001).

TABLE 18: COMPARISON OF MDW VALUES BETWEEN THE TWO GROUPS FROM DAY 1 TO DAY 7

	CONFIRMED SEPSIS				PROBABLE SEPSIS				Z	
	Mean	SD	Median	IQR	Mean	SD	Median	IQR		
DAY1 MDW	33.94	8.42	36.10	26.625-41.675	25.34	6.60	22.05	21.3025-28.09	-4.675	0.001
DAY2 MDW	34.15	8.78	36.55	25.8-41.675	24.84	6.75	21.45	20.7-27.7875	-4.845	0.001
DAY3 MDW	33.63	8.21	34.44	27.225-40	24.43	6.77	21.30	20-26.875	-4.938	0.001
DAY4 MDW	32.53	7.47	33.55	28.075-38.945	23.24	5.54	21.30	19.5-24	-5.688	0.001
DAY5 MDW	31.57	7.28	32.35	26.3325-38.3	22.45	4.82	21.00	19-23.43	-5.916	0.001
DAY6 MDW	30.51	7.00	30.08	26-36.975	21.81	4.21	20.10	19-23	-6.158	0.001
DAY7 MDW	29.59	6.90	28.00	25-35	21.37	4.12	21.00	19-23.7	-6.223	0.001
MDW	32.31	7.21	32.23	28.65-38.52	23.62	5.88	20.81	19.76-25.81	-5.416	0.001

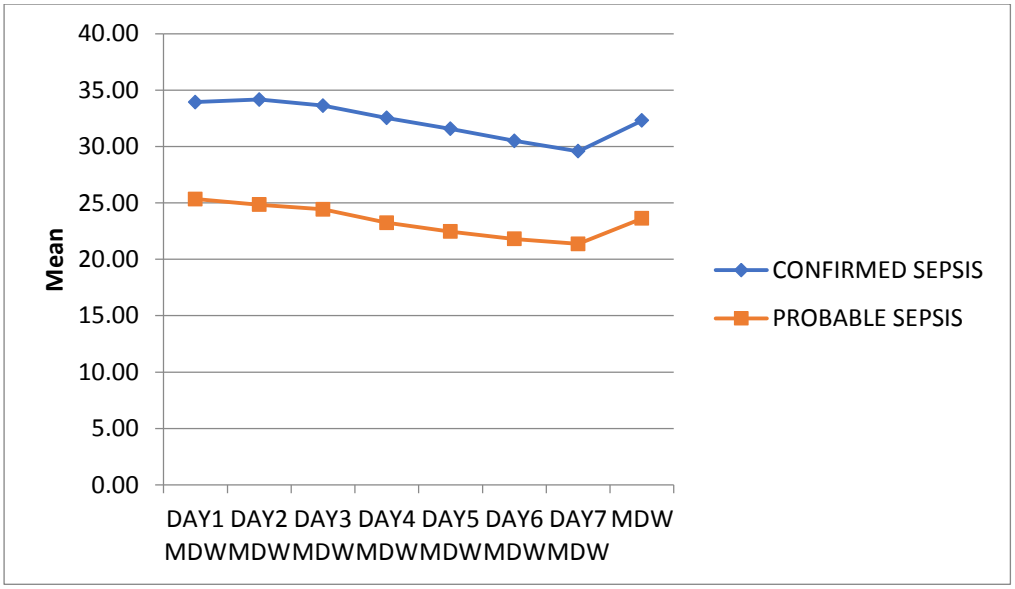

FIGURE 20: COMPARISON OF MDW VALUES BETWEEN THE TWO GROUPS FROM DAY 1 TO DAY 7

The data showed a significant difference in values of Monocyte Distribution Width (MDW) between patients with confirmed sepsis and those with probable sepsis across all seven days of monitoring (p value= 0.001).

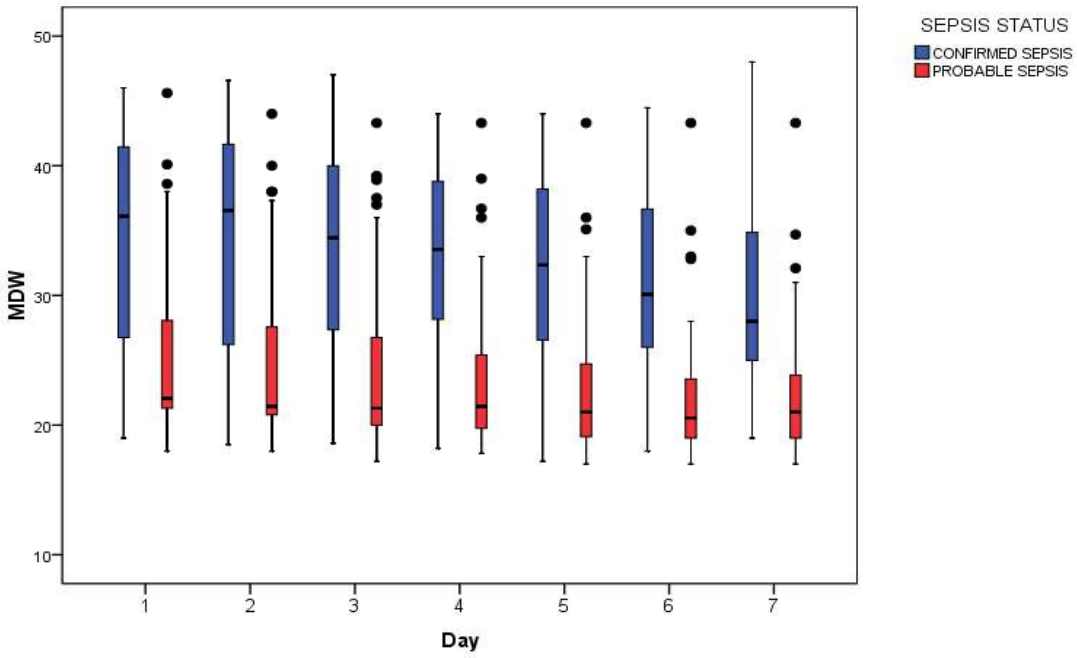

FIGURE 21: BOX WHISKER PLOT OF MDW FROM DAY 1 TO DAY 7. MDW VALUES WERE CONSISTENTLY HIGHER IN THE CONFIRMED SEPSIS GROUP ACROSS ALL SEVEN DAYS, AS INDICATED BY THE POSITION OF THE BLUE BOXES COMPARED TO THE RED BOXES

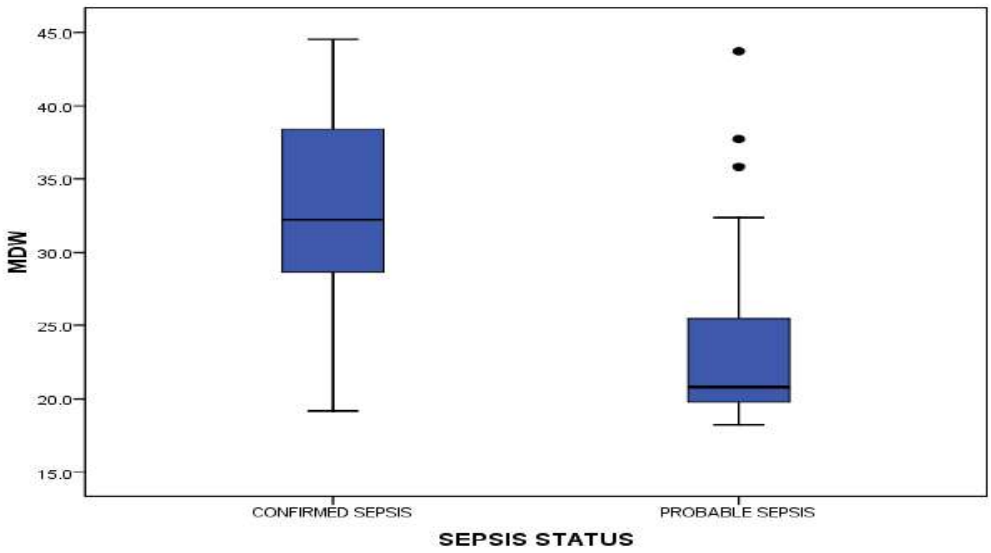

FIGURE 22: BOX AND WHISKER PLOT OF MDW COMPARING CONFIRMED AND PROBABLE SEPSIS. THE CONFIRMED SEPSIS GROUP EXHIBITED A NOTABLY HIGHER MEDIAN MDW VALUE THAN THE PROBABLE SEPSIS GROUP

TABLE 19: COMPARISON OF PCT VALUES BETWEEN THE TWO GROUPS FROM DAY 1 TO DAY 2

	CONFIRMED SEPSIS				PROBABLE SEPSIS				Z	P VALUE
PCT(ng/ml)	Mean	SD	Median	IQR	Mean	SD	Median	IQR		
DAY1 PCT	18.40	14.69	16.15	6.7-28.675	11.87	16.12	2.50	1.085-25.435	-1.355	0.176
DAY2 PCT	16.66	27.17	7.90	4.5-11.6	5.13	5.45	3.40	0.9-9.31	-2.419	0.016
PCT	17.29	23.26	10.12	5-19.4	7.29	10.35	3.40	0.90-9.42	-2.976	0.003

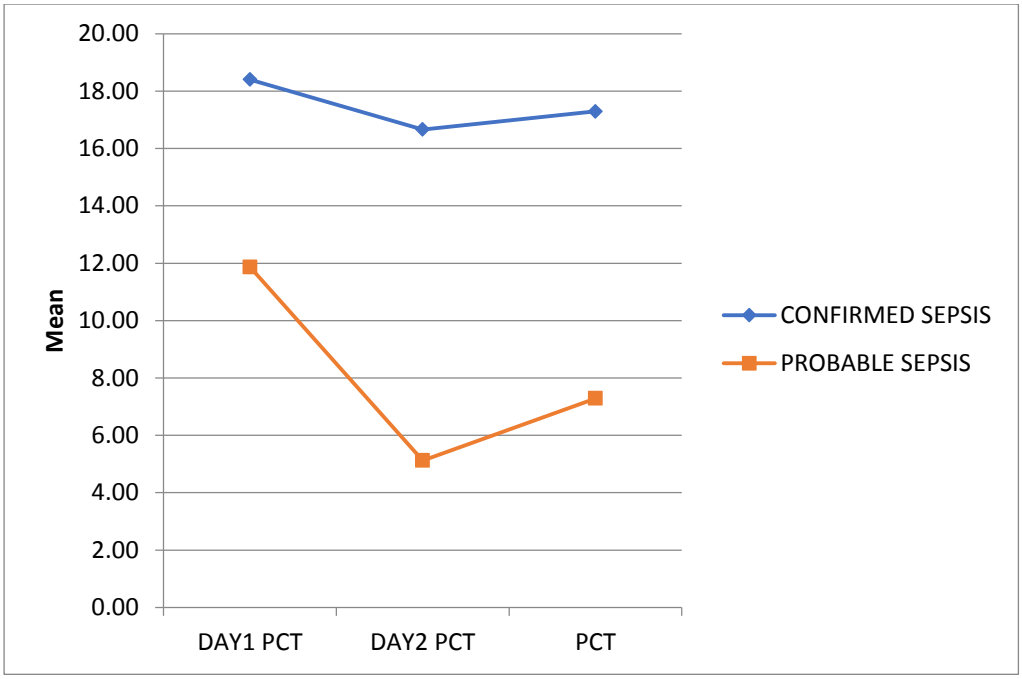

FIGURE 23: COMPARISON OF PCT VALUES BETWEEN THE TWO GROUPS FROM DAY 1 TO DAY 2

The mean and median PCT levels on Day 2 were considerably elevated in the confirmed sepsis group compared to the probable sepsis group, as indicated by a p-value of 0.016. When data from both days were analyzed together, the confirmed sepsis group continued to show significantly higher mean and median PCT levels, resulting in a p-value of 0.003, demonstrating a highly statistically significant difference between the two groups.

TABLE 20: PERFORMANCE OF MDW IN IDENTIFYING SEPSIS AT DIFFERENT CUT-OFF POINTS

	> 20		> 21		> 22		> 23	
Statistic	Value	95% CI	Value	95% CI	Value	95% CI	Value	95% CI
Sensitivity	92.31%	81.46% to 97.86%	88.46%	76.56% to 95.65%	86.54%	74.21% to 94.41%	78.85%	65.30% to 88.94%
Specificity	29.17%	16.95% to 44.06%	52.08%	37.19% to 66.71%	62.50%	47.35% to 76.05%	66.67%	51.59% to 79.60%
Positive Likelihood Ratio	1.3	1.07 to 1.59	1.85	1.35 to 2.52	2.31	1.58 to 3.38	2.37	1.55 to 3.61
Negative Likelihood Ratio	0.26	0.09 to 0.75	0.22	0.10 to 0.49	0.22	0.10 to 0.44	0.32	0.18 to 0.56
Disease prevalence	52.00%	41.78% to 62.10%	52.00%	41.78% to 62.10%	52.00%	41.78% to 62.10%	52.00%	41.78% to 62.10%
Positive Predictive Value	58.54%	53.67% to 63.24%	66.67%	59.44% to 73.18%	71.43%	63.08% to 78.53%	71.93%	62.64% to 79.66%
Negative Predictive Value	77.78%	55.31% to 90.82%	80.65%	65.18% to 90.27%	81.08%	67.53% to 89.83%	74.42%	62.39% to 83.61%
AUC	62.00%	51.75% to 71.52%	71.00%	61.07% to 79.64%	75.00%	65.34% to 83.12%	73.00%	63.20% to 81.39%

We evaluated the diagnostic performance of MDW at different thresholds (>20, >21, >22, >23).

Sensitivity decreases as the threshold increases. 92.31% at >20 suggests that the test is very good at identifying sepsis cases at this lower threshold. However, this drops to 78.85% at >23, meaning the higher threshold misses more true sepsis cases**.** Specificity improves as the threshold increases. It starts low at 29.17% at >20 but rises to 66.67% at >23.

Positive Likelihood Ratio (PLR) increases from 1.3 at >20 to 2.37 at >23. A PLR > 1 indicates that a positive test result is associated with the presence of the disease. A PLR of 1.3 at >20 suggests only a slight increase in the odds of having sepsis when the test is positive, while a PLR of 2.37 at >23 shows a moderate increase. Negative Likelihood Ratio (NLR) improves (decreases) up to a threshold of >22, with a value of 0.22, before increasing to 0.32 at >23. A lower NLR is better for ruling out disease. AN NLR of 0.22 at >22 suggests that a negative test at this threshold reduces the likelihood of sepsis considerably. An NLR of 0.32 at >23 is slightly worse but still useful.

Positive Predictive Value (PPV) rises from 58.54% at >20 to 71.93% at >23. This means that the probability of having sepsis when the test is positive increases as the threshold increases. Negative Predictive Value (NPV) remains fairly stable across thresholds, peaking at 81.08% at >22, then dropping slightly to 74.42% at >23. NPV represents the likelihood that a negative test result correctly identifies someone without sepsis. The relatively high NPV values suggest that a negative result is fairly reliable across all thresholds.

Area Under the Curve (AUC) improves from 62.00% at >20 to 75.00% at >22, but slightly decreases to 73.00% at >23. AUC measures the overall diagnostic accuracy of the test. An AUC of 75% means that the test has moderate discriminative ability at >22, with an optimal balance between sensitivity and specificity.

TABLE 21: PERFORMANCE OF PCT AS A SEPSIS BIOMARKER

	PCT > 1(ng/ml)	
Statistic	Value	95% CI
Sensitivity	94.87%	82.68% to 99.37%
Specificity	32.14%	15.88% to 52.35%
Positive Likelihood Ratio	1.4	1.07 to 1.82
Negative Likelihood Ratio	0.16	0.04 to 0.68
Disease prevalence (*)	58.21%	45.52% to 70.15%
Positive Predictive Value	66.07%	59.90% to 71.74%
Negative Predictive Value	81.82%	51.27% to 95.06%
AUC	68.66%	56.16% to 79.44%

The sensitivity of PCT > 1 was found to be 94.87%, indicating a high probability of correctly identifying patients with the disease. However, the specificity was considerably lower, at 32.14% reflecting a limited ability to correctly identify those without the disease. The Positive Predictive Value (PPV) was 66.07%, indicating that approximately two-thirds of patients with a positive PCT result had the disease. The Negative Predictive Value (NPV) was 81.82%, suggesting a high probability that patients with a negative PCT result were truly disease-free. The Area Under the Receiver Operating Characteristic Curve (AUC) was calculated to be 68.66%, reflecting a fair overall accuracy of PCT > 1 in differentiating between sepsis and non-sepsis patients.

TABLE 22: PERFORMANCE OF THE NL RATIO TO IDENTIFY SEPSIS AT DIFFERENT CUT-OFF POINTS

	> 5		> 6		> 10.4	
Statistic	Value	95% CI	Value	95% CI	Value	95% CI
Sensitivity	92.31%	81.46% to 97.86%	88.46%	76.56% to 95.65%	55.77%	41.33% to 69.53%
Specificity	31.25%	18.66% to 46.25%	39.58%	25.77% to 54.73%	79.17%	65.01% to 89.53%
Positive Likelihood Ratio	1.34	1.09 to 1.65	1.46	1.14 to 1.88	2.68	1.47 to 4.89
Negative Likelihood Ratio	0.25	0.09 to 0.69	0.29	0.13 to 0.67	0.56	0.40 to 0.78
Disease prevalence (*)	52.00%	41.78% to 62.10%	52.00%	41.78% to 62.10%	52.00%	41.78% to 62.10%
Positive Predictive Value (*)	59.26%	54.20% to 64.13%	61.33%	55.29% to 67.05%	74.36%	61.36% to 84.12%
Negative Predictive Value (*)	78.95%	57.22% to 91.31%	76.00%	58.00% to 87.89%	62.30%	54.09% to 69.85%
Accuracy (*)	63.00%	52.76% to 72.44%	65.00%	54.82% to 74.27%	67.00%	56.88% to 76.08%

The diagnostic performance of the Neutrophil-to-Lymphocyte Ratio (NLR) was evaluated at three different cutoff values: > 5, > 6, and > 10.4. An NLR > 5 was useful for ruling out disease due to its high sensitivity of 92.31%, whereas NLR > 10.4 was more reliable for confirming disease presence, given its higher specificity of 79.17% and PPV of 74.36%.

TABLE 23: DIAGNOSTIC PERFORMANCE OF TLC AT VALUES < 4000 AND >11,000/MM³

	TLC < 4000 and >11000/ mm³	
Statistic	Value	95% CI
Sensitivity	88.46%	76.56% to 95.65%
Specificity	47.92%	33.29% to 62.81%
Positive Likelihood Ratio	1.7	1.27 to 2.27
Negative Likelihood Ratio	0.24	0.11 to 0.54
Disease prevalence (*)	52.00%	41.78% to 62.10%
Positive Predictive Value (*)	64.79%	57.96% to 71.06%
Negative Predictive Value (*)	79.31%	63.07% to 89.59%
Accuracy (*)	69.00%	58.97% to 77.87%

TLC values outside the normal range (<4000 or >11,000/mm³) provided a highly sensitive test (88.46%) for detecting sepsis, which makes it useful for identifying patients with the disease. However, the lower specificity (47.92%) and moderate positive predictive value (64.79%) indicate that TLC alone may lead to a higher rate of false positives.

TABLE 24: COMPARISON OF MDW WITH PCT, NL RATIO, AND TLC PERFORMANCE FOR SEPSIS DETECTION

	MDW+PCT		MDW+PCT+NL RATIO		MDW+PCT+NL RATIO+TLC	
Statistic	Value	95% CI	Value	95% CI	Value	95% CI
Sensitivity	92.31%	81.46% to 97.86%	98.08%	89.74% to 99.95%	100.00%	93.15% to 100.00%
Specificity	47.92%	33.29% to 62.81%	25.00%	13.64% to 39.60%	14.58%	6.07% to 27.76%
Positive Likelihood Ratio	1.77	1.34 to 2.35	1.31	1.11 to 1.55	1.17	1.04 to 1.32
Negative Likelihood Ratio	0.16	0.06 to 0.43	0.08	0.01 to 0.57	0	
Disease prevalence (*)	52.00%	41.78% to 62.10%	52.00%	41.78% to 62.10%	52.00%	41.78% to 62.10%
Positive Predictive Value (*)	65.75%	59.14% to 71.80%	58.62%	54.50% to 62.62%	55.91%	53.02% to 58.77%
Negative Predictive Value (*)	85.19%	68.19% to 93.91%	92.31%	61.84% to 98.89%	100.00%	59.04% to 100.00%
Accuracy (*)	71.00%	61.07% to 79.64%	63.00%	52.76% to 72.44%	59.00%	48.71% to 68.74%

The diagnostic performance of combining Monocyte Distribution Width (MDW), Procalcitonin (PCT), Neutrophil-to-Lymphocyte Ratio (NLR), and Total Leukocyte Count (TLC) was evaluated across three different combinations: MDW+PCT, MDW+PCT+NLR, and MDW+PCT+NLR+TLC. The combination of MDW + PCT offers a good balance between sensitivity (92.31%) and specificity (47.92%), making it a reliable first-line tool for identifying sepsis. Adding the NL Ratio improves sensitivity (98.08%) but decreases specificity (25%), leading to more false positives. Including TLC provides the highest sensitivity (100%) and NPV (100%) but at the cost of very low specificity (14.58%).

TABLE 25: AREA UNDER THE CURVE FOR ROC OF TLC, NLRATIO, AND MDW AS MARKERS OF SEPSIS IN THE SAMPLE POPULATION

Test Result Variable(s)	Area	Std. Error	p-value	Asymptotic 95% Confidence Interval	
				Lower Bound	Upper Bound
TLC	.725	.052	.000	.622	.827
NL RATIO	.735	.051	.000	.635	.834
MDW	.814	.044	.000	.729	.900

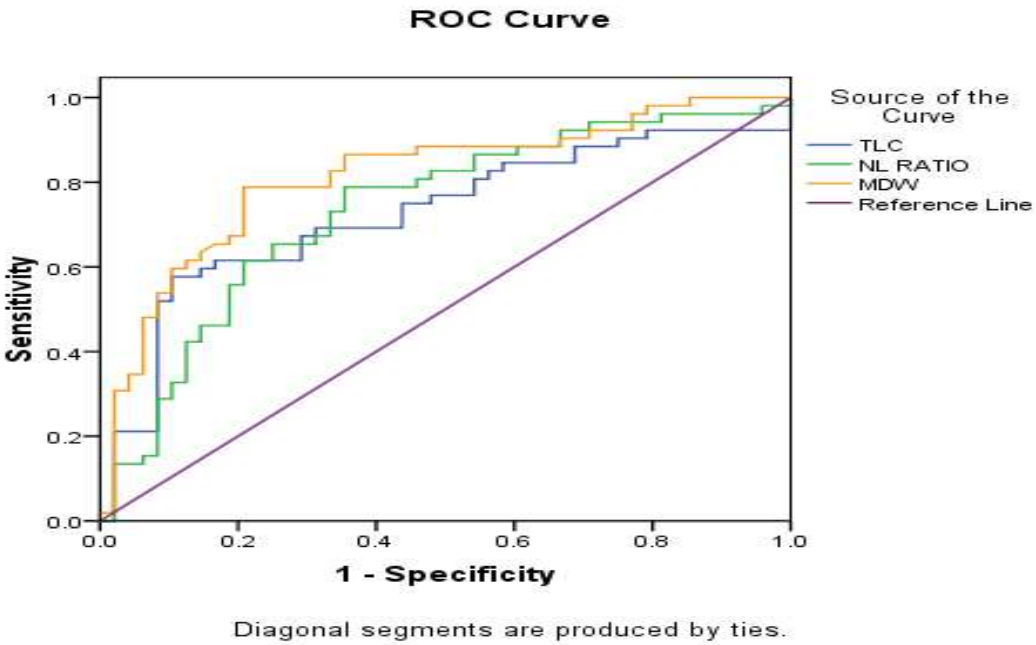

FIGURE 24: ROC CURVE DEPICTING DIAGNOSTIC ACCURACY OF TLC, NL RATIO, AND MDW AS A MARKER OF SEPSIS IN SAMPLE POPULATION

MDW exhibited the highest diagnostic accuracy among the markers, with an AUC of 0.814, indicating strong discriminatory power for sepsis detection. The NL ratio also performed well, with an AUC of 0.735, demonstrating moderate diagnostic accuracy. TLC had the lowest AUC at 0.725, but still showed a moderate ability to differentiate between sepsis and non-sepsis cases, reflecting its utility in clinical assessment.

TABLE 26: AREA UNDER THE CURVE FOR ROC OF PCT AS A MARKER OF SEPSIS IN THE SAMPLE POPULATION

Area	Std. Error	p-value	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
0.714	0.066	0.003	0.584	0.844

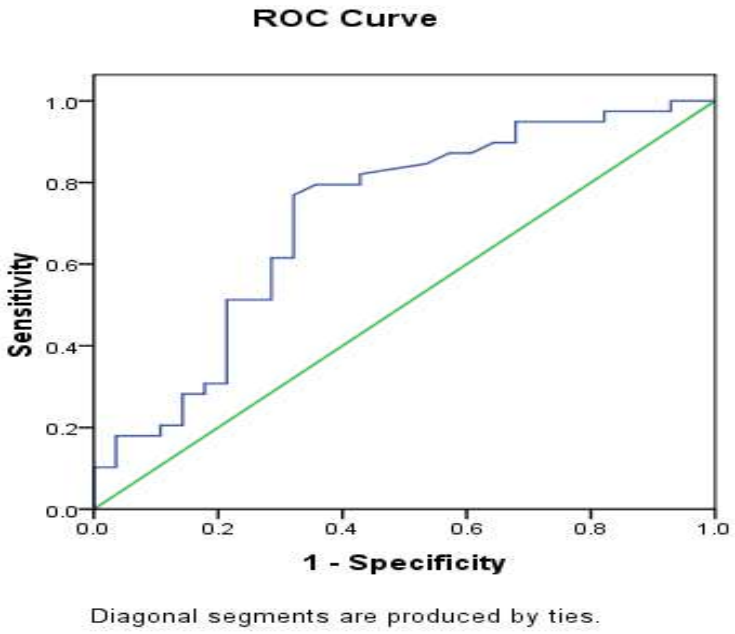

FIGURE 25: ROC CURVE DEPICTING DIAGNOSTIC ACCURACY OF PCT AS A MARKER OF SEPSIS IN THE SAMPLE POPULATION

The AUC of 0.714 indicates that PCT has a moderate diagnostic performance in distinguishing between sepsis and non-sepsis cases.

TABLE 27: CORRELATION BETWEEN MDW AND OTHER BIOMARKERS USING SPEARMAN'S RANK CORRELATION

			MDW
Spearman's rho	TLC	Correlation Coefficient	.559
		Sig. (2-tailed)	.001
		N	100
	NL RATIO	Correlation Coefficient	.460
		Sig. (2-tailed)	.001
		N	100
	PCT	Correlation Coefficient	.629
		Sig. (2-tailed)	.001
		N	67

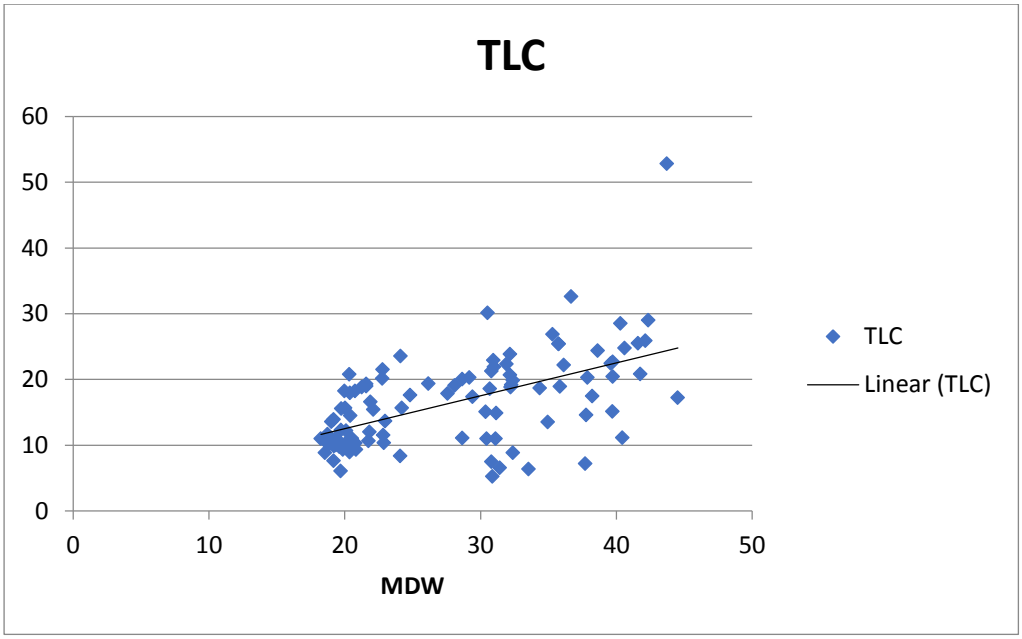

FIGURE 26: CORRELATION OF MDW WITH TLC

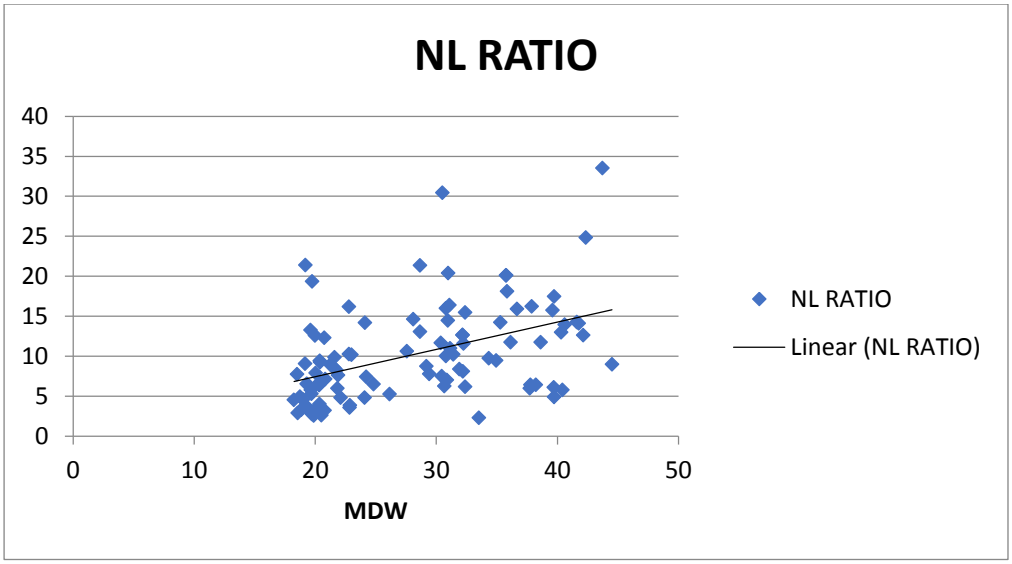

FIGURE 27: CORRELATION OF MDW WITH NL RATIO

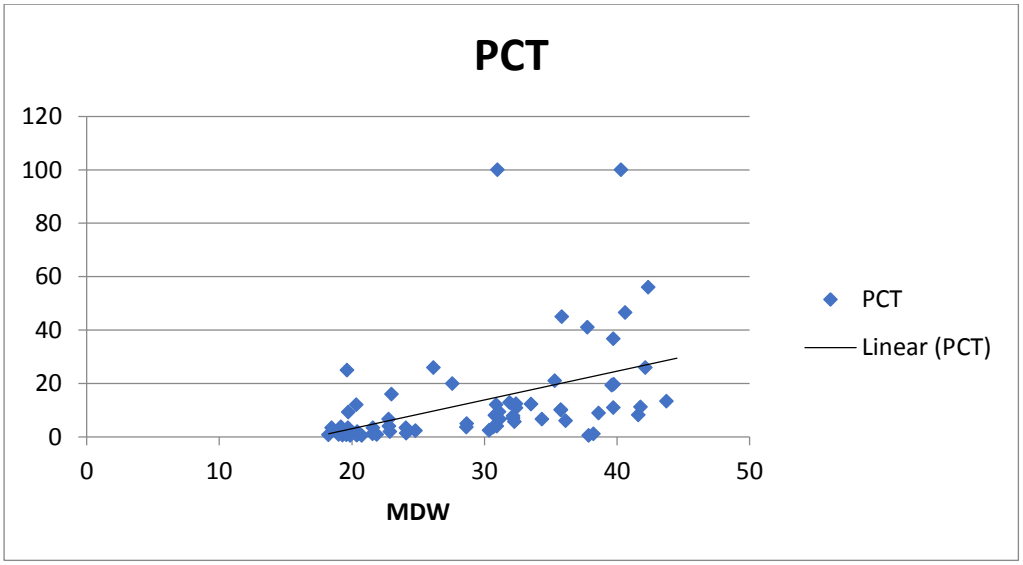

FIGURE 28: CORRELATION OF MDW WITH PCT

In the study, we examined the correlation between Monocyte Distribution Width (MDW) and various inflammatory and hematologic markers, including Total Leukocyte Count (TLC), Neutrophil-to-Lymphocyte (NL) Ratio, Procalcitonin (PCT) employing Spearman's rank correlation.

MDW and TLC: A moderate positive correlation was identified between MDW and TLC, with a Spearman's correlation coefficient of 0.539 ($p = 0.000$, $N = 100$), which was statistically significant.

MDW and NL Ratio: Similarly, MDW exhibited a moderate positive correlation with the NL Ratio, resulting in a Spearman's correlation coefficient of 0.460 ($p = 0.000$, $N = 100$).

MDW and PCT: The correlation between MDW and PCT was stronger, with a Spearman's correlation coefficient of 0.629 ($p = 0.000$, $N = 67$), indicating a strong association between these two markers.

TABLE 28: RESULTS OF UNIVARIATE LOGISTIC REGRESSION TO PREDICT CONFIRMED SEPSIS IN THE SAMPLE

	p-value	Odd ratio	95% C.I.for Odd ratio	
			Lower	Upper
MDW>22	0.001	10.714	3.990	28.769
PCT>1	0.009	8.763	1.719	44.680
SBP	0.021	0.965	0.936	0.995
GCS	0.008	0.845	0.747	0.957
TEMP	0.014	1.419	1.075	1.873
SOFA	0.007	1.266	1.067	1.503
NLRATIO>10.4	0.002	1.151	1.055	1.256

A univariate logistic regression analysis revealed that both Monocyte Distribution Width (MDW) and Procalcitonin (PCT) were strong predictors of sepsis, with odds ratios of 10.714 and 8.763, respectively. Temperature (OR: 1.419) and SOFA score (OR: 1.266) also significantly predicted sepsis. In contrast, the Glasgow Coma Scale (GCS) and systolic blood pressure (SBP) were inversely associated with sepsis risk, with odds ratios of 0.845 and 0.965, respectively.

TABLE 29: RESULTS OF MULTIVARIATE LOGISTIC REGRESSION TO PREDICT CONFIRMED SEPSIS IN THE SAMPLE

	p-value	Odd ratio	95% C.I.for Odd ratio	
			Lower	Upper
NLRATIO>10.4	0.452	0.955	0.847	1.077
MDW>22	0.015	9.991	1.573	63.448
PCT>1	0.208	4.372	0.440	43.426
GCS	0.049	0.796	0.635	0.999
TEMP	0.020	1.823	1.097	3.028
SBP	0.853	1.005	0.956	1.055
SOFA	0.572	0.922	0.696	1.222

A multivariate logistic regression analysis was conducted to identify independent predictors of confirmed sepsis in the study population. MDW values exceeding 22 were found to be a significant independent predictor of sepsis ($p = 0.001$), with an odds ratio of 10.122. Furthermore, the Glasgow Coma Scale (GCS) ($p = 0.006$) and body temperature ($p = 0.042$) were also identified as independent predictors, with odds ratios of 0.779 and 1.447, respectively.

DISCUSSION

Unlike the delayed neutrophil response often seen in viral infections, circulating monocytes act as immediate responders, with their numbers correlating with the intensity of microbial exposure.[10] Blood monocytes serve as a transitional stage between their production site and the site of action during infection. Consequently, evaluating monocyte activation through MDW can provide a direct indication of the infection's level and stage.[70]

Research on the use of monocyte distribution width (MDW) as a biomarker for sepsis among ICU patients is scarce, with only a limited number of studies conducted. Previous research has highlighted the utility of MDW as a screening tool for the early detection of patients at risk for sepsis in the emergency department (ED).[65,73-74] This study involved a prospective observational design and focused on patients admitted to the intensive care units of our hospital. A total of 100 patients were enrolled based on predefined inclusion criteria and were classified into two categories: confirmed sepsis (n = 52) and probable sepsis (n = 48), based on positive culture results or serological tests.

In the present study, both the groups were comparable with similar age distribution, and gender. The mean age of the confirmed sepsis group was 48.21 ± 15.70 years and 46.67 ± 13.67 years in the probable sepsis group. There was no statistically significant difference in the age distribution of both groups (p-value = 0.54). Males accounted for a slightly higher proportion of cases in both the confirmed sepsis and probable sepsis groups constituting 63.5% and 62.5% respectively. Liu et al. (2023)[70], Polilli et al. (2020)[62], and Agnello et al. (2020)[74] also reported a similar distribution in their study.

A statistically insignificant difference was seen between the two groups when the groups were compared based on the presence of a history of HTN, Diabetes, Hypothyroidism, and CAD except for COPD (p value= 0.02). This higher frequency of sepsis indicates that these patients are more prone to sepsis. However, it will not affect the sensitivity and

specificity. Polilli et al (2020)[62] in their study found a significant association for Diabetes mellitus, while M. Encabo et al. (2023)[69] in their study found no difference in the distribution of comorbidities between the two groups of infected and non- infected patients.

Heart Rate (HR), Diastolic Blood Pressure (DBP), Oxygen Saturation (SpO2), and Respiratory Rate (RR) did not show significant differences between confirmed and probable sepsis groups. Systolic Blood Pressure (SBP) was lower in patients with confirmed sepsis (mean SBP = 113.85 mmHg) compared to those with probable sepsis (mean SBP = 120.67 mmHg) and the observed difference was statistically significant, with a p-value of 0.015. These findings are consistent with the study conducted by M. Encabo et al. (2023).[69]

Our data indicated that patients with confirmed sepsis exhibited more severe clinical manifestations, characterized by lower GCS scores, higher temperatures, and elevated SOFA scores (p-values of 0.008, 0.004, and 0.034, respectively). However, lactate levels at admission were comparable across both groups (p = 0.666). Similarly, M. Encabo et al. (2023)[69] found a notable difference in temperature between infected and non-infected patients, while they reported no significant differences in SOFA scores and lactate levels upon admission. Likewise, Kralovcova et al. (2024)[75] observed no significant difference in lactate levels between patients with and without sepsis. Additionally, Polilli et al. (2021)[60] documented significant differences in average SOFA scores at admission between patients with sepsis and those without. Woo et al (2021)[65] reported significant differences in lactate levels and SOFA scores at emergency department admission in their study. In contrast to our study, they included immunocompromised patients, a population we specifically excluded from our analysis.

In our study, abdomen was identified as the source of sepsis in 48% of patients, followed by lungs in 17%, brain in 13%, bloodstream infections in 7%, surgical site infections (SSI) in 6%, and the urinary tract in 8% of cases. In contrast, Crouser et al. (2019)[14] reported lungs as the leading source of sepsis in 32% of patients, followed by urinary tract in 22%, and abdomen in 13%. The high prevalence of abdominal

sepsis in our cohort likely reflects that nearly half of the patients were enrolled from the Surgical ICU.

A higher percentage of patients requiring mechanical ventilation on admission to the ICU were found in the confirmed sepsis group (71.2%) compared to the probable sepsis group (56.3%). But, the chi-square test did not reveal a statistically significant difference between the groups (p = 0.15). However, the mean duration of mechanical ventilation for patients with confirmed sepsis was 7.27 days (SD = 5.16), with a median of 6.00 days and an interquartile range (IQR) of 3.00-9.50 days. For patients with probable sepsis, the mean duration was 3.07 days (SD = 2.20), with a median of 2.00 days and an IQR of 2.00-4.00 days. The Z value was -4.242, with a p-value of 0.001, indicating a statistically significant difference in the duration of mechanical ventilation between the two groups. The longer duration of mechanical ventilation in confirmed sepsis cases aligns with the understanding that severe sepsis frequently leads to increased organ dysfunction, including respiratory failure.

The requirement of vasopressor support on admission to the ICU was more commonly associated with confirmed sepsis cases (65.4%) compared to probable sepsis cases (39.6%) and the difference was statistically significant (p = 0.02) suggesting that the presence of septic shock was significantly associated with confirmed sepsis. Our analysis also revealed a significant difference in the duration of antibiotic therapy between patients with confirmed sepsis and those with probable sepsis. In patients with confirmed sepsis group, antibiotics were modified as per the culture sensitivity findings.

Patients with confirmed sepsis also had a significantly longer mean ICU stay compared to those with probable sepsis, with the difference being statistically significant. In contrast, Polilli et al. (2021)[60] reported no notable difference in the average length of ICU stay between patients with and without sepsis.

In the confirmed sepsis group, 19.2% (n = 10) of patients died, compared to 4.2% (n = 2) in the probable sepsis group, with this difference being statistically significant (p-value = 0.021). M. Encabo et

al. (2023)[69], Polilli et al. (2021)[60], and Malinovska et al. (2022)[68] also reported significant differences in ICU mortality between patients with sepsis and those without.

Monocyte distribution width (MDW), Procalcitonin (PCT), Total leukocyte count (TLC), and Neutrophil to lymphocyte ratio (NL ratio) for sepsis detection in ICU

Monocyte distribution width (MDW)

MDW was consistently elevated in patients with confirmed sepsis compared to those with probable sepsis. On Day 1, the mean MDW for confirmed sepsis was 33.94 (median 36.10), significantly higher than the 25.34 (median 22.05) observed in probable sepsis, with a p-value of 0.001. This trend was evident throughout the observation period, with the largest differences seen on Days 6 and 7, where the MDW for confirmed sepsis was 30.51 (median 30.08) and 29.59 (median 28.00), respectively, compared to 21.81 (median 20.10) and 21.37 (median 21.00) for probable sepsis, both with p-values of 0.001. Liu et al. (2023)[70] also measured the trend of MDW values from day 1 to day 6 between survivors and non-survivors. MDW levels measured on day 3 and day 6 were significantly lower in survivors compared to non-survivors in their study. Piva et al. (2021)[59], Polilli et al. (2021)[60] and M. Encabo et al. (2023)[69] reported significantly higher MDW values in ICU patients diagnosed with sepsis or septic shock compared to their non-septic counterparts. Furthermore, Agnello et al. (2020)[74] found that patients admitted to the ICU with an initial clinical diagnosis of sepsis had elevated MDW levels compared to those who developed sepsis during their stay in the ICU.

MDW, a metric for monocyte anisocytosis, exhibited excellent accuracy in identifying sepsis in this observational study. For the prediction of sepsis, the area under the curve (AUC) for MDW, as determined by ROC curve analysis, was 0.814 (95% CI: 0.729 – 0.900), aligning well with findings from prior studies. Specifically, Piva et al. (2021)[59] reported an area under the curve (AUC) of 0.785 for MDW, while Polilli et al. (2021)[60] found it to be 0.76. Crouser et al. (2019)[14] indicated an

AUC of 0.727, and Woo et al. (2021)[65] recorded an AUC of 0.71. Hausfater et al. (2021)[66] reported a slightly higher AUC of 0.81. These results demonstrate the consistent efficacy of MDW as a predictive marker for sepsis.

The cut-off values used in previous studies varied, ranging from 20 to 27. Research on the optimal cut-off point for MDW as a sepsis predictor has yielded different results: Crouser et al. (2019)[14] identified a threshold of 20, while Polilli et al. (2020)[62] found 21.9 to be most effective, and Agnello et al. (2020)[74] determined it to be 23.5. Kralovcova et al. (2024)[75] established a statistically optimal cut-off of 21 for predicting infection and 22 for predicting sepsis. These discrepancies can be attributed to the varying clinical settings and characteristics of the study populations involved.[69] In our assessment of MDW as a diagnostic tool for sepsis, we analyzed its performance across different threshold values. The sensitivity was highest at a threshold of >20 (92.31%) but declined as the threshold increased, dropping to 78.85% at >23. Importantly, the positive likelihood ratio (PLR), negative likelihood ratio (NLR), positive predictive value (PPV), and negative predictive value (NPV) improved with higher thresholds. However, the optimal cut-off value for MDW identified in our study, which demonstrated comparable sensitivity and specificity, was 22. This threshold provided a sensitivity of 86.54% (95% CI: 74.21–94.41) and a specificity of 62.50% (95% CI: 47.35–76.05), with a positive likelihood ratio (LR+) of 2.31 (95% CI: 1.58–3.38) and a negative likelihood ratio (LR−) of 0.22 (95% CI: 0.10–0.44). The positive predictive value was 71.43% (95% CI: 63.08–78.53) and the negative predictive value was 81.08% (95% CI: 67.53–89.83). These results align with those of Hausfater et al. (2021)[66], who reported a sensitivity of 81% and a specificity of 69% at an MDW cut-off of 21.5, further validating the diagnostic utility of MDW. Conversely, Polilli et al. (2020)[62] reported a sensitivity of 94.3% and a specificity of 69.7% at an MDW cut-off of 22.

A systematic review and meta-analysis that encompassed 10 studies involving a total of 9,475 participants, including 1,370 individuals

diagnosed with sepsis (742 classified under Sepsis-2 and 628 under Sepsis-3), reported pooled sensitivity and specificity values of 0.789 and 0.777 for the Sepsis-2 criteria, respectively, and 0.838 and 0.704 for the Sepsis-3 criteria. These findings support our results, highlighting MDW as a dependable biomarker for screening sepsis.[76]

The higher MDW in confirmed sepsis suggests a more pronounced monocyte activation or a greater degree of systemic inflammation. The persistent elevation in MDW across multiple days indicates that patients with confirmed sepsis experience a more severe inflammatory and immune response compared to those with probable sepsis. Crouser et al.[14] in their study demonstrated that MDW effectively differentiates sepsis from SIRS, with higher MDW levels correlating with increased infection severity and organ dysfunction, rising in parallel with the progression of sepsis. The high AUC suggests that MDW can be a valuable addition to current diagnostic practices for sepsis. Its use could enhance early detection and management of sepsis, potentially improving patient outcomes through timely intervention.

Procalcitonin (PCT)

PCT is a widely recognized biomarker for diagnosing infections in current clinical practice, with several studies demonstrating its effectiveness in accurately identifying bacterial infections and detecting patients with bacteremia.[69] Beyond its role as a classical biomarker, PCT also aids clinicians in the de-escalation of antibiotic treatment. Our overall analysis revealed that confirmed sepsis patients had significantly higher PCT levels (mean = 17.29) compared to probable sepsis patients (mean = 7.29), with a p-value of 0.003. our results were in concordance with the study done by Kralovcova et al. (2024)[75] and Polilli et al. (2021).[60] The area under the curve (AUC) of PCT, obtained by the ROC curve analysis, was 0.714 (95% CI; 0.584 – 0.844) lower than that for MDW. We also evaluated the diagnostic performance of Procalcitonin (PCT) at values more than 1 ng/mL to predict sepsis in the studied cohort. The sensitivity of PCT > 1 was found to be 94.87%, indicating a high probability of correctly identifying

patients with the disease. However, the specificity was considerably lower, at 32.14% (95% CI: 15.88% to 52.35%), reflecting a limited ability to correctly identify those without the disease. The Positive Predictive Value (PPV) was 66.07% (95% CI: 59.90% to 71.74%), indicating that approximately two-thirds of patients with a positive PCT result had the disease. The Negative Predictive Value (NPV) was 81.82% (95% CI: 51.27% to 95.06%), suggesting a high probability that patients with a negative PCT result were truly disease-free. However, Polilli et al. (2021)[60] reported that PCT values greater than 1 had a sensitivity of 64.9 %, specificity of 77.8%, Positive Predictive Value (PPV) of 80%, Negative Predictive Value (NPV) of 61.8%, and AUC of 0.71 (0.63–0.79).

Neutrophil to lymphocyte ratio (NL ratio)

Our study evaluated the neutrophil-to-lymphocyte ratio (NLR) across seven days for patients with confirmed versus probable sepsis. The analysis of the neutrophil-to-lymphocyte ratio (NLR) over seven days demonstrated significant differences between patients with confirmed sepsis and those with probable sepsis.

Day-by-Day NLR: The NLR was significantly elevated in patients with confirmed sepsis compared to those with probable sepsis across all seven days. For instance, on Day 1, the mean NLR for confirmed sepsis was 12.00, whereas it was 8.65 for probable sepsis, with a p-value of 0.009. This pattern of higher NLR in confirmed sepsis persisted throughout the observation period, with the most pronounced differences observed on Days 6 and 7 (mean NLR of 10.32 and 9.15 for confirmed sepsis, respectively, compared to 5.81 and 4.89 for probable sepsis, both with p-values of 0.001). Liu et al. (2023)[70] also assessed the neutrophil-to-lymphocyte ratio (NL ratio) on days 1, 3, and 6 in adult septic patients who survived and those who did not. They found a significant difference in the NL ratio between survivors and non-survivors on days 3 and 6.

Numerous prior studies have evaluated the prognostic significance of the neutrophil-to-lymphocyte ratio (NLR) in patients with sepsis using ROC/AUC analysis. Liu et al. (2016)[77] reported an AUC of 0.695,

identifying a high NLR threshold (≥23.8) as a cut-off value. In another study, Akilli et al. (2014)[78] found an AUC of 0.61 with a cut-off of NLR ≥11.9. In our research, NLR also demonstrated a significant AUC of 0.735, with a cut-off value of 10.4, although it exhibited a lower sensitivity of 55.77% alongside a good specificity of 79.17%.

Total Leukocyte Count (TLC)

Our data demonstrated significant differences in total leukocyte count (TLC) between patients with confirmed and probable sepsis across seven days of monitoring. Our results were consistent with the research done by Kralovcova et al.(2024)[75] and Polilli et al. (2022).[67] However, studies done by M. Encabo et al. (2023)[69] and Liu et al (2023)[70] did not demonstrate significant differences in the TLC values between the two groups.

TLC exhibited moderate diagnostic accuracy as a marker for sepsis with an AUC of 0.750, high sensitivity (88.46%), and acceptable predictive values with a PPV of 64.79% and NPV of 79.31. In contrast, Malinovska et al.(2022)[68] reported that in patients with sepsis but without septic shock, total leukocyte counts (TLC) <4000 and >12000/mm³ yielded an area under the curve (AUC) of 0.77 (95% CI: 0.73–0.81), with a sensitivity of 60.6% (53.4–67.7), specificity of 81.3% (80.5–82.2), positive predictive value (PPV) of 7.0 (5.7–8.3), and negative predictive value (NPV) of 98.9 (98.6–99.1). In patients with septic shock, the AUC increased to 0.79 (95% CI: 0.71–0.87), with a sensitivity of 65.1% (50.9–79.4), specificity of 80.6% (79.8–81.5), PPV of 1.8 (1.1–2.5), and NPV of 99.8 (99.6–99.9).

MDW in combination with other biomarkers

The combination of MDW and PCT showed considerable promise in the early identification of sepsis, achieving a high sensitivity of 92.31%. This indicates that the MDW-PCT combination is particularly effective in recognizing patients at risk for sepsis. However, the moderate specificity of 47.92% suggests that there may be a significant number of false positives, which could lead to unnecessary interventions. Despite this limitation, the overall accuracy of 71.00% and a notable

NPV of 85.19% highlighted the utility of this biomarker combination for ruling out sepsis in clinical practice.

Previous studies, such as those by Polli et al. (2021)[60] have shown that combining MDW values > 22.0 with PCT levels > 0.5 µg/L yields a sensitivity of 71.2%, specificity of 88.7% PPV of 89.7%, and NPV of 69.1%. Their findings, reflected in an AUC of 0.80, reinforce the effectiveness of this diagnostic strategy. Similarly, Hausfater et al. (2021)[66] reported an AUC of 0.82 for MDW values > 21.5 combined with PCT levels > 0.25 µg/L in septic patients. This concordance with the present study highlights the value of MDW and PCT as diagnostic tools for the detection of sepsis.

Adding the neutrophil-to-lymphocyte ratio (NLR) to the MDW-PCT combination further increased sensitivity to 98.08%, indicating high effectiveness in detecting sepsis. However, this enhancement came at the cost of reduced specificity (25.00%), resulting in a higher likelihood of false positives. The NPV remained very high at 92.31%, reinforcing the utility of this combination for ruling out the disease, although overall accuracy dropped to 63.00%.

Incorporating total leukocyte count (TLC) with MDW, PCT, and NLR achieved a perfect sensitivity of 100%, indicating that this combination detected all true cases. However, specificity drastically declined to 14.58%, signifying a high likelihood of false positives.

While adding biomarkers like NLR and TLC to the MDW-PCT combination enhanced sensitivity, it significantly reduced specificity, leading to more false positives. The MDW-PCT combination offered a balanced approach with relatively high sensitivity and moderate specificity, making it potentially the most practical option for clinical use.

Clinical Correlations

We have also attempted to find out if any correlation exists between MDW and other biomarkers. A stronger positive correlation was observed between MDW and PCT, with a Spearman's correlation coefficient of 0.629 ($p = 0.000$, $N = 67$), indicating a strong association between these two markers. MDW also exhibited a moderate positive

correlation with the NL Ratio and TLC, with a Spearman's correlation coefficient of 0.460 and 0.539 respectively. Piva et al. (2021)[59] also reported a positive correlation between MDW and PCT (Spearman's rho 0.543, p<0.001) in overall patients and patients with sepsis Spearman rank correlation rho was 0.425 (p<0.001).

A univariate logistic regression analysis was conducted to assess the predictive value of several clinical parameters MDW, PCT, SBP, GCS, temperature, and SOFA score in predicting sepsis. MDW > 22 (an odds ratio of 10.714) emerged as the strongest predictor, with a more than tenfold increased likelihood of sepsis, reinforcing the clinical utility of MDW in the early detection of sepsis. Additionally, the study by Hausfater et al. (2021)[66] found that MDW values exceeding 21.5 yielded odds ratios of 5.5 and 7.6 when patients were categorized according to Sepsis-2 and Sepsis-3 criteria, respectively. A strong association was also seen between elevated PCT levels (an odds ratio of 8.763) and sepsis risk which further supports the role of PCT as a biomarker in sepsis diagnosis. Temperature and SOFA score were also significant predictors of sepsis, with an odds ratio of 1.419 and 1.266 respectively. GCS scores and SBP (an odds ratio of 0.845 and 0.965) both were inversely related to sepsis, indicating that hemodynamic instability and deteriorating neurological function are critical markers of sepsis progression.

A multivariate logistic regression analysis was also performed to determine the independent predictors of confirmed sepsis in the sample population. MDW >22 (odds ratio 10.12) continued to be a robust predictor of sepsis, confirming its clinical utility even after adjusting for confounding factors. The consistency of MDW's predictive power across both univariate and multivariate analyses suggests its potential role as a key biomarker for early sepsis detection. Polilli et al. (2021)[60] reported a significant association for MDW > 23, with an odds ratio of 17.64 in their multivariate regression analysis. Similarly, Kralovcova et al. (2024)[75] found that MDW with an odds ratio of 1.083 was independently associated with the development of sepsis.

GCS (odds ratio 0.779) also emerged as an important independent predictor, with lower scores indicating an increased risk of sepsis. Temperature (odds ratio 1.447) another critical factor, remained independently associated with sepsis, indicating that febrile responses are key to identifying patients at risk for sepsis. However, SBP which was significant in the univariate analysis, did not maintain its significance in the multivariate model, suggesting that the impact of SBP on sepsis risk may be confounded by other variables. Similarly, the lack of significance for the SOFA score may indicate that while organ dysfunction is integral to the progression of sepsis; it may not be a strong early predictor when assessed alongside other clinical parameters like MDW, GCS, and temperature.

LIMITATIONS

1 The study included a limited sample size of only 100 patients, which may affect the robustness of the results.

2 This study was conducted at a single center which limits the ability to generalize the results to a wider population.

3. Blood cultures and other investigations, including biomarkers, were ordered based on clinical suspicion of infection as recommended by the physician. For instance, in our study, procalcitonin (PCT) was done in only 70 cases, while CRP was not included in the final results as it was ordered in a few number of patients.

4. We lack insights into the performance of Monocyte Distribution Width (MDW) in immunocompromised individuals, those with hematological disorders, burn victims, and patients suffering from chronic kidney disease (CKD) and chronic liver disease (CLD), as these groups were deliberately excluded from our study 5 While efforts were made to adjust for confounding factors, there may still be unaccounted variables, such as pre-existing conditions, that could influence the results.

SUMMARY AND CONCLUSION

SUMMARY

We conducted an institutional and prospective Observational study in a tertiary care hospital. We enrolled 100 patients as per the sepsis 3 criteria and based on positive culture sensitivity and positive serology reports patients were divided into confirmed sepsis and probable sepsis. We recorded the baseline characteristics and followed the trend of MDW and other biomarkers like PCT, TLC, and NL ratio over the period of seven days. The primary goal of our study was to assess the diagnostic effectiveness of MDW both independently and in conjunction with other biomarkers.

SALIENT FINDINGS:

1 MDW levels were significantly higher in confirmed sepsis patients across all observation days.

2 MDW demonstrated good diagnostic performance for sepsis, with an AUC of 0.814. The optimal cutoff value for MDW was 22, yielding a sensitivity of 86.54% and a specificity of 62.50%. MDW showed a strong positive correlation with other biomarkers, such as PCT, NL ratio, and TLC.

3 Procalcitonin (PCT) levels were significantly higher in confirmed sepsis (mean 17.29) than in probable sepsis (mean 7.29, $p = 0.003$), but MDW outperformed PCT in diagnostic accuracy (AUC: 0.714 for PCT vs. 0.814 for MDW).

4 Neutrophil-to-Lymphocyte Ratio (NLR) was consistently higher in confirmed sepsis patients, with a significant difference observed over the seven days ($p = 0.001$).

5 Total Leukocyte Count (TLC) was also significantly higher in confirmed sepsis patients (AUC: 0.750), though its diagnostic accuracy was moderate.

6 Combining MDW and PCT enhanced sepsis detection, with a sensitivity of 92.31% and an accuracy of 71%. However, specificity was moderate (47.92%)

7 Univariate analysis showed MDW ≥ 22 as the strongest predictor of sepsis (odds ratio of 10.714). Multivariate analysis confirmed MDW's independent predictive value (odds ratio of 10.12), further reinforcing its role as a key biomarker in early sepsis detection.

8 MDW showed a strong correlation with PCT (Spearman's correlation coefficient of 0.629) and moderate correlations with NLR and TLC, indicating its association with systemic inflammation and infection severity

CONCLUSION:

This study demonstrates that Monocyte Distribution Width (MDW) is a valuable and effective biomarker for diagnosing sepsis in critically ill ICU patients. MDW showed significant elevation in confirmed sepsis cases compared to probable sepsis throughout the observation period. Its diagnostic performance, reflected by an AUC of 0.814**,** outperformed other commonly used biomarkers such as procalcitonin (PCT) and the neutrophil-to-lymphocyte ratio (NLR)**.** The study confirms that MDW is a reliable, early indicator of sepsis and improves diagnostic accuracy when incorporated into clinical decision-making processes. MDW's strong correlation with traditional inflammatory markers further emphasizes its importance in detecting the systemic inflammatory response seen in septic patients. Given its diagnostic robustness, MDW has the potential to support clinicians in making timely therapeutic decisions, ultimately improving patient outcomes in the ICU. Nonetheless, further studies involving larger populations are required to confirm these findings and assess MDW's applicability across diverse clinical environments.

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S.NO	MRD	AGE(years)	SEX	COMORBITIES	beats/min	SBP(mmHg)	DBP(mmHg)	SPO2(%)	RR(Breaths/ minute)	GCS	CNS	TEMPERATURE(°F)	BASELINE ARTERIAL BLOOD GAS
1	1704507	60	FEMALE	HTN,DM	97	112	76	98	18	3	E1VTM1	98	METABOLIC ACIDOSIS
2	1669989	45	MALE	NIL	127	104	75	100	28	7	E1VT M5	99	NORMAL
3	1711895	55	MALE	NIL	110	109	64	97	14	15	E4V5M6	99.8	NORMAL
4	1713039	36	MALE	NIL	60	110	60	96	16	11	E4VTM6	101	METABOLIC ACIDOSIS
5	1557949	60	FEMALE	HTN	129	110	60	95	25	11	E4VTM6	101	NORMAL
6	57743	52	FEMALE	NIL	88	118	71	100	20	11	E4VTM6	98	METABOLIC ACIDOSIS WITH RESPIRATORY ALKALOSIS
7	1558942	65	MALE	COPD	90	100	70	100	18	11	E4VTM6	96.4	NORMAL
8	1687142	45	MALE	HTN	126	128	80	96	18	11	E4VTM6	99	METABOLIC ACIDOSIS
9	1197267	67	MALE	HTN,HYPOTHYROID,CAD	71	110	70	99	20	4	E2VTM1	96	METABOLIC ACIDOSIS
10	1588683	68	MALE	NIL	108	126	74	80	14	6	E1VTM4	100	HYPOXEMIA
11	1589211	40	FEMALE	NIL	110	110	60	98	18	15	E3V5M6	99	NORMAL
12	1570473	40	FEMALE	NIL	160	90	60	96	30	13	E3V5M5	100	METABOLIC ACIDOSIS
13	1599921	36	MALE	NIL	110	120	90	96	48	15	E4V5M6	101	NORMAL
14	1598376	44	MALE	NIL	112	130	70	99	20	10	E4VTM5	99	METABOLIC ACIDOSIS
15	1599921	36	MALE	NIL	110	130	76	98	18	7	E1VTM5	98.6	METABOLIC ACIDOSIS
16	1599968	70	MALE	HTN	91	150	90	98	20	15	E4V5M6	100	NORMAL
17	1600221	40	MALE	HTN	98	100	60	98	20	3	E1VTM1	99	METABOLIC ACIDOSIS WITH RESPIRATORY ACIDOSIS
18	820419	58	MALE	HTN,DM	67	120	80	98	16	15	E4V5M6	101	NORMAL
19	1590787	43	MALE	HTN	80	130	80	98	20	15	E4V5M6	98	METABOLIC ACIDOSIS
20	1670071	65	MALE	NIL	100	110	60	95	20	7	E1VTM5	96	METABOLIC ACIDOSIS
21	1555988	53	MALE	HTN	95	150	94	97	16	9	E3VTM5	97	NORMAL
22	1541155	34	MALE	HT	88	140	90	100	14	7	E1VTM5	100	NORMAL
23	1526692	72	FEMALE	HTN,DM	96	110	70	96	18	13	E3V4M6	98	NORMAL
24	553466	45	MALE	CAD	100	100	64	98	20	15	E4V5M6	96	METABOLIC ACIDOSIS
25	1393524	24	MALE	NIL	98	110	70	95	17	15	E4V5M6	99	NORMAL
26	1586381	25	MALE	NIL	100	110	60	97	22	10	E4VTM5	95	NORMAL
27	1567506	69	FEMALE	HTN	98	124	74	98	16	11	E4VTM6	98	NORMAL
28	1563919	44	MALE	HTN,DM	102	124	60	96	18	15	E4V5M6	101.3	METABOLIC ACIDOSIS
29	1522637	70	FEMALE	DM	114	164	80	98	20	10	E3VTM6	100.7	NORMAL
30	1553412	60	FEMALE	HYPOTHYROID	90	160	70	96	18	9	E3VTM5	101	METABOLIC ACIDOSIS
31	1181277	60	MALE	HTN,DM	99	115	66	95	18	14	E3V5M6	99	NORMAL
32	1525939	32	FEMALE	NIL	90	106	66	98	20	7	E1VTM5	102	METABOLIC ACIDOSIS
33	1715691	24	MALE	NIL	110	96	60	97	16	9	E3VTM5	97	METABOLIC ACIDOSIS
34	1501307	61	MALE	DM	100	124	60	98	16	15	E4V5M6	99	NORMAL

S.NO	MRD	AGE(years)	SEX	SOURCE	DIAGNOSIS	SOFA	MECHANICAL VENTILATION	DURATION OF MECHANICAL VENTILATION	VASOPRESSOR SUPPORT	LACTATE
1	1704507	60	FEMALE	ABDOMEN	CAECAL PERFORATION	3	YES	6 DAYS	YES	1.7
2	1669989	45	MALE	ABDOMEN	PANCREATIC NECROSECTOMY	6	NO	NIL	NO	0.9
3	1711895	55	MALE	ABDOMEN	C/O ROAD SIDE ACCIDENT WITH BLUNT TRAUMA ABDOMEN	7	NO	NIL	NO	4.5
4	1713039	36	MALE	SSI	CERVICAL SPINE INJURY S/P ACDF WITH SURGICAL SITE INFECTION	4	YES	4 DAYS	YES	4.5
5	1557949	60	FEMALE	LUNG	RIGHT DIAPHRAGMATIC PALSY, LOWER RESPIRATORY TRACT INFECTION, ACUTE KIDNEY INJURY	8	YES	10 DAYS	YES	2.8
6	57743	52	FEMALE	ABDOMEN	P/O/C/O LAPAROSCOPIC CHOLECYSTECTOMY	4	NO	NIL	YES	6
7	1558942	65	MALE	SSI	C/O ROAD SIDE ACCIDENT WITH DEGLOVING INJURY RIGHT LOWER LIMB	4	YES	2 DAYS	NO	0.5
8	1687142	45	MALE	ABDOMEN	PERFORATION PERITONITIS S/P EXPLORATORY LAPOROTOMY	2	YES	3 DAYS	YES	4.6
9	1197267	67	MALE	ABDOMEN	ILEAL PERFORATION S/P EXPLORATORY LAPOROTOMY	2	YES	8 DAYS	YES	1.7
10	1588683	68	MALE	LUNG	ASPIRATION PNEUMONIA WITH ACUTE KIDNEY INJURY	6	YES	16 DAYS	YES	1.7
11	1589211	40	FEMALE	BRAIN INJURY	POLYTRAUMA WITH SAH WITH FACIAL FRACTURE	2	NO	NIL	NO	5
12	1570473	40	FEMALE	URINARY TRACT	B/L NEPHROLITHIASIS WITH P/O DJ STENTING	11	YES	7 DAYS	YES	3.7
13	1599921	36	MALE	URINARY TRACT	P/C/O B/L PCNL WITH SHOCK	6	NO	NIL	YES	2.2
14	1598376	44	MALE	ABDOMEN	ACUTE PANCREATITIS WITH ACUTE KIDNEY INJURY	3	YES	14 DAYS	NO	1.1
15	1599921	36	MALE	BRAIN	C/O ROAD SIDE ACCIDENT WITH SUBDARACHNOID HEMORRHAGE	4	YES	3 DAYS	YES	8.9
16	1599968	70	MALE	URINARY TRACT	ACUTE FEBRILE ILLNESS WITH ACUTE KIDNEY INJURY	3	NO	NIL	NO	1.1
17	1600221	40	MALE	BRAIN	TUBERCULAR MENINGITIS	7	YES	12 DAYS	YES	2.4
18	820419	58	MALE	URINARY TRACT	URINARY TRACT INFECTION	4	NO	NIL	NO	2
19	1590787	43	MALE	ABDOMEN	ACUTE CHOLECYSTITIS WITH ACUTE KIDNEY INJURY	6	NO	NIL	YES	1.2
20	1670071	65	MALE	ABDOMEN	P/C/O OPEN CHOLECYSTECTOMY WITH LOOP ILEOSTOMY	10	YES	11 DAYS	YES	1.5
21	1555988	53	MALE	ABDOMEN	A/H/O GUNSHOT INJURY S/P EXPLORATORY LAPOROTOMY WITH ILEOSTOMY	6	YES	2 DAYS	NO	5.1
22	1541155	34	MALE	BRAIN	INTRACRANIAL HEMORRHAGE	7	YES	4 DAYS	NO	2.2
23	1526692	72	FEMALE	URINARY TRACT	URINARY TRACT INFECTION WITH ENCEPHALOPATHY	6	NO	NIL	NO	2
24	553466	45	MALE	ABDOMEN	P/O/C/O OPEN CHOLECYSTECTOMY WITH SHOCK	5	YES	4 DAYS	YES	10
25	1393524	24	MALE	LUNG	C/O FEVER WITH TYPE I RESPIRATORY FAILURE	3	NO	NIL	NO	2.1
26	1586381	25	MALE	ABDOMEN	C/0 ROAD SIDE ACCIDENT WITH BLUNT TRAUMA ABDOMEN	8	YES	3 DAYS	YES	4
27	1567506	69	FEMALE	ABDOMEN	C/O APPENDICULAR PERFORATION S/P EXPLORATORY LAPOROTOMY	7	YES	2 DAYS	NO	2.4
28	1563919	44	MALE	ABDOMEN	C/O CHOLEDOCHOLITHIASIS WITH CHOLANGITIS WITH ACUTE KIDNEY INJURY	4	NO	NIL	YES	3.1
29	1522637	70	FEMALE	ABDOMEN	S/P RIGHT HEMICOLECTOMY WITH ILEOSTOMY WITH ACUTE KIDNEY INJURY	10	YES	2 DAYS	YES	1.2
30	1553412	60	FEMALE	ABDOMEN	OBSTRUCTED UMBILICAL HERNIA S/P EXPLORATORY LAPOROTOMY	12	YES	2 DAYS	NO	1.5
31	1181277	60	MALE	LUNG	ROAD SIDE ACCIDENT WITH PNEUMOMEDIASTINUM WITH RIGHT RIB FRACTURE	4	NO	NIL	NO	2
32	1525939	32	FEMALE	ABDOMEN	P/O/C/O TOTAL ABDOMINAL HYSTERECTOMY WITH PERFORATION PERITONITIS	10	YES	3 DAYS	YES	2.4
33	1715691	24	MALE	ABDOMEN	C/0 ROAD SIDE ACCIDENT WITH BLUNT TRAUMA ABDOMEN WITH FEMUR FRACTURE	4	YES	1 DAY	YES	2
34	1501307	61	MALE	ABDOMEN	C/O ACUTE PANCREATITIS	2	NO	NIL	NO	2.5

S.NO	MRD	AGE(years)	SEX	DAY 1 TLC(×10³/mm³)	DAY2 TLC(×10³/mm³)	DAY 3 TLC(×10³/mm³)	DAY 4 TLC(×10³/mm³)	DAY 5 TLC(×10³/mm³)	DAY 6 TLC(×10³/mm³)	DAY 7 TLC(×10³/mm³)	DAY 1 NL RATIO	DAY2 NL RATIO	DAY3 NL RATIO	DAY4 NL RATIO
1	1704507	60	FEMALE	12.7	6.6	9.9	12.5	13.4	11.4	11	16.5	17.34	27	33
2	1669989	45	MALE	33.76	22.8	21.4	18.8	16.4	18.4	18.9	18	20	19.2	17
3	1711895	55	MALE	12.4	14	17.8	16	13	12.4	12	5.6	10.8	9.6	5.7
4	1713039	36	MALE	22	25.5	24.2	20.1	20	17	16.1	13.4	17	18.9	10.9
5	1557949	60	FEMALE	16	16.7	20.5	21.8	19.5	17.3	16	4.7	10.8	20	17.8
6	57743	52	FEMALE	20.7	18.5	23.6	22.5	21	20	16.7	4.9	6.7	7.8	4.3
7	1558942	65	MALE	28.9	28	26.7	22.1	19.8	17.4	14	15.6	18	20.6	18.1
8	1687142	45	MALE	10.7	9.4	9	7.8	6	5.7	4.8	8.6	16	11	8.8
9	1197267	67	MALE	7.1	10.3	11.5	20.4	13.1	18.5	28.8	3.9	2	2.3	9.5
10	1588683	68	MALE	11.9	34.3	29	22.3	16	17	15	4.1	10.5	9.4	7.4
11	1589211	40	FEMALE	5.7	10	12	14	10	8.4	6	3.8	8.9	8.1	7.6
12	1570473	40	FEMALE	2.8	17.5	20.5	18	17	16	14	6.8	7.35	6.96	7.1
13	1599921	36	MALE	6.6	14.5	14	11	10	10.2	7	11	8.1	7.4	4.3
14	1598376	44	MALE	16.4	14.5	16.8	20	24	26	28	3.2	11	13.4	14
15	1599921	36	MALE	24	17	16.7	10.5	10	7.8	7.7	10.1	8.3	8	7.6
16	1599968	70	MALE	21.7	24.5	21.4	17.8	17	16.7	16	13.4	12.1	10.3	9.2
17	1600221	40	MALE	26.6	30.4	31.8	27.1	20.8	18.4	18.1	26.7	24.5	16.3	13.1
18	820419	58	MALE	16.2	21.7	17.2	13.8	13	12.1	11.6	15.2	16.1	18.3	16.1
19	1590787	43	MALE	31	27.1	17.3	25.6	24.6	20	19.2	17.8	19.3	11.9	15.9
20	1670071	65	MALE	24.2	20.5	22.2	33.5	34.5	36	40	15.25	9.9	46	33
21	1555988	53	MALE	15.6	6.1	3.3	2.9	4.4	8.3	11.5	10.8	7.6	4.5	4.4
22	1541155	34	MALE	17.1	16.3	16	10	10.4	8.6	6.5	7.34	6.54	6.2	3.3
23	1526692	72	FEMALE	3.4	3.9	4.3	6.63	6.07	6.4	6	11.4	10.3	9.4	4.8
24	553466	45	MALE	21.1	22	23.4	20.1	19.1	16	11	5.6	10.9	12.1	13.4
25	1393524	24	MALE	11	11.2	13	10.6	9.3	9.1	8	4.1	3.8	3.9	3.3
26	1586381	25	MALE	4.2	9.2	10.7	13.99	16.1	30.9	35.5	7.2	5.6	3.6	5.8
27	1567506	69	FEMALE	11.72	8.5	8.93	7.8	5.7	5	11	10.58	5.9	3.9	3.4
28	1563919	44	MALE	40.6	22	16.79	12.1	11	11.9	7.9	8.5	9.9	10	4.8
29	1522637	70	FEMALE	21.2	20.1	19.2	19	18.9	14.2	13.2	15	11	11.4	10
30	1553412	60	FEMALE	5	6.3	9.5	10.11	12.3	14.1	11	20.19	20.43	14.82	11
31	1181277	60	MALE	16.5	15.5	18	24.41	17.8	17	14	3.9	4.5	4.5	12
32	1525939	32	FEMALE	21.43	13.97	12	7.8	6.9	5	5.4	7.8	5.6	3.5	3.23
33	1715691	24	MALE	18	20.45	22	17	11	10	7.6	6.5	7.52	3	3.12
34	1501307	61	MALE	17.06	16	15	17.39	18.1	13.4	12	17.6	32	9.75	9.8

S.NO	MRD	AGE(years)	SEX	DAY5 NL RATIO	DAY6 NL RATIO	DAY 7 NL RATIO	DAY1 MDW	DAY2 MDW	DAY3 MDW	DAY4 MDW	DAY5 MDW	DAY6 MDW	DAY7 MDW	DAY1 PCT(ng/ml)	DAY2 PCT(ng/ml)
1	1704507	60	FEMALE	24	21	10.6	32.8	30.61	30.1	27.2	27	26.8	26.1	-	**5**
2	1669989	45	MALE	12.9	12.27	14	28	27.6	26	26	24	23.56	23	-	4
3	1711895	55	MALE	4.3	4.4	4.1	21	21.3	21	20.2	20	19.8	19	-	0.9
4	1713039	36	MALE	9.7	9.8	8.7	34.6	34	33.7	33	31	30	28.9	-	7.9
5	1557949	60	FEMALE	12.1	11	9.8	24.46	26	26.7	28	26.1	23	21	0.56	-
6	57743	52	FEMALE	3.9	3.3	3.2	43.57	43	41.1	40	38	37.5	35	19.7	-
7	1558942	65	MALE	15	11.9	11	41	41.7	43	39.1	39	37.4	36	19.4	-
8	1687142	45	MALE	7.9	7	4.1	28.1	28	27.2	26.17	26	25.1	26	-	3.8
9	1197267	67	MALE	11.6	11	15	23.87	24	24.5	27.24	21.14	24	28	-	-
10	1588683	68	MALE	5.8	4.8	4.1	21	33	33.2	33.3	28.4	28	25	-	12
11	1589211	40	FEMALE	7.1	4.5	3.1	32	34	36	36.7	33	28	27	-	12.4
12	1570473	40	FEMALE	7	3.8	3.6	43	44	45	40	38	34	34	36.7	-
13	1599921	36	MALE	3.4	3.1	3	34.19	34	33	27.6	27	24	24	24.97	-
14	1598376	44	MALE	16	20.1	21	43.1	43	40	39.1	41	43	43.2	-	11.2
15	1599921	36	MALE	5.2	4.9	3.2	21.35	21.1	21	20	20.4	19.8	19.1	-	0.9
16	1599968	70	MALE	5.6	4.9	4.2	28.9	28.5	28.1	26.1	25.3	25	23	-	1.2
17	1600221	40	MALE	7.8	5.3	3.8	44	43.3	42	41	38.9	38.1	37	46.6	-
18	820419	58	MALE	7.2	4.7	4.1	27.77	23.38	27.6	34.09	34	33	32.7	2.5	-
19	1590787	43	MALE	18	8.9	7.3	28.49	28	23.96	23.12	23.11	21	21	1.41	-
20	1670071	65	MALE	36	36.3	36.7	26.5	27	27.1	30	34	34.23	34.7	-	-
21	1555988	53	MALE	7.6	3.5	3.3	40.1	40	39.22	39	36	35	34.69	-	-
22	1541155	34	MALE	3.12	2.76	2.34	19.7	18.76	18.13	18	18	18.13	17	0.76	-
23	1526692	72	FEMALE	4.9	4.3	4.1	37.55	37.1	30.36	28.74	28	27.52	26.89	12	-
24	553466	45	MALE	11	8.9	7.1	31.3	31	29.5	28	27.7	27	26	-	3.4
25	1393524	24	MALE	3.1	2.3	2	23	21.1	21	21	20	20	19.4	-	-
26	1586381	25	MALE	6.3	15.25	19.1	44.12	44	43.35	43.71	44	44.45	48	-	-
27	1567506	69	FEMALE	3.56	3.2	3.1	28.12	25.46	25.37	23.98	23.12	21.14	21.32	3.4	-
28	1563919	44	MALE	4.4	4.1	3.2	42	40	40	37.83	37.1	35.6	35.1	-	1.2
29	1522637	70	FEMALE	7.8	6.4	4.3	25.94	25.1	25	24.76	24.32	24.1	22	-	0.7
30	1553412	60	FEMALE	10.1	8.9	7.4	23.1	22.8	22.7	21.3	21	20	21	0.8	-
31	1181277	60	MALE	8.68	7	4.8	28	27.15	25.67	24	23.43	23	22.43	2.3	-
32	1525939	32	FEMALE	2.4	2	2.3	28.41	25	24.7	23	21	21	19	2	-
33	1715691	24	MALE	2	2.12	2.5	21.31	21.91	20	18	18.41	17.81	17	2.5	-
34	1501307	61	MALE	30	19.27	17	28	28	26.48	25.05	25	21	21	-	9.31

S.NO	MRD	AGE(years)	SEX	DAY3 PCT(ng/ml)	DAY4 PCT(ng/ml)	DAY5 PCT(ng/ml)	DAY6 PCT(ng/ml)	DAY7 PCT(ng/ml)	BLOOD C/S	URINE C/S	ENDOTRACHEAL C/S
1	1704507	60	FEMALE	-	-	-	-	-	STAPHYLOCOCCUS HEMOLYTICUS	NO GROWTH	NOT SENT
2	1669989	45	MALE	-	-	-	-	-	NOT SENT	NO GROWTH	NOT SENT
3	1711895	55	MALE	-	-	-	-	-	NOT SENT	NOT SENT	NOT SENT
4	1713039	36	MALE	-	-	-	-	-	NO GROWTH	NO GROWTH	KLEBSIELLA PNEUMONIAE
5	1557949	60	FEMALE	-	-	-	-	-	NOT SENT	NO GROWTH	NO GROWTH
6	57743	52	FEMALE	-	-	-	-	10	E COLI	NO GROWTH	NOT SENT
7	1558942	65	MALE	-	-	-	-	-	NOT SENT	NO GROWTH	NOT SENT
8	1687142	45	MALE	-	-	-	-	-	NOT SENT	NOT SENT	NOT SENT
9	1197267	67	MALE	-	-	-	-	-	NO GROWTH	NO GROWTH	ACINETOBACTER BAUMANII
10	1588683	68	MALE	-	-	-	-	6	NO GROWTH	NO GROWTH	FILMARRAY ET= KLEBSIELLA PNEUMONIAE , ECOLI
11	1589211	40	FEMALE	-	-	-	-	-	NOT SENT	NOT SENT	NOT SENT
12	1570473	40	FEMALE	-	-	-	20	-	NOT SENT	E COLI	NO GROWTH
13	1599921	36	MALE	-	-	-	-	-	NOT SENT	NOT SENT	NOT SENT
14	1598376	44	MALE	-	-	-	-	-	E COLI	NIL	NO GROWTH
15	1599921	36	MALE	-	-	-	-	-	NOT SENT	NOT SENT	NOT SENT
16	1599968	70	MALE	-	-	-	-	-	KLEBSIELLA PNEUMONIAE	NO GROWTH	NOT SENT
17	1600221	40	MALE	-	-	-	-	10.4	NO GROWTH	NO GROWTH	CBNAAT POSITIVE
18	820419	58	MALE	-	-	-	-	-	NO GROWTH	E COLI	NOT SENT
19	1590787	43	MALE	-	-	0.9	-	-	NOT SENT	NOT SENT	NOT SENT
20	1670071	65	MALE	23	-	-	-	-	NO GROWTH	NO GROWTH	NO GROWTH
21	1555988	53	MALE	-	8.25	-	-	-	NOT SENT	NOT SENT	NOT SENT
22	1541155	34	MALE	-	-	-	-	-	NOT SENT	NOT SENT	NOT SENT
23	1526692	72	FEMALE	-	-	-	-	-	NO GROWTH	KLEBSIELLA PNEUMONIE	NOT SENT
24	553466	45	MALE	-	-	-	-	-	NOT SENT	NO GROWTH	NOT SENT
25	1393524	24	MALE	0.8	-	-	-	-	NOT SENT	NO GROWTH	NOT SENT
26	1586381	25	MALE	-	-	-	-	-	NO GROWTH	CANDIDA TROPICALIS	NO GROWTH
27	1567506	69	FEMALE	-	-	-	-	-	NOT SENT	NOT SENT	NOT SENT
28	1563919	44	MALE	-	-	-	-	-	NOT SENT	NOT SENT	NOT SENT
29	1522637	70	FEMALE	-	-	-	-	-	NOT SENT	NO GROWTH	NOT SENT
30	1553412	60	FEMALE	-	-	-	-	-	NO GROWTH	NO GROWTH	NOT SENT
31	1181277	60	MALE	1.4	-	-	0.55	-	NO GROWTH	NO GROWTH	NOT SENT
32	1525939	32	FEMALE	-	-	-	-	-	NO GROWTH	NO GROWTH	NOT SENT
33	1715691	24	MALE	-	-	-	-	-	NOT SENT	NO GROWTH	NOT SENT
34	1501307	61	MALE	-	-	-	-	-	NOT SENT	NOT SENT	NOT SENT

S.NO	MRD	AGE(years)	SEX	OTHERS	SEROLOGY	SEPSIS STATUS	DURATION OF ANTIBIOTICS	LENGTH OF ICU STAY	OUTCOME
1	1704507	60	FEMALE	PERITONEAL C/S= E COLI	BETA D GLUCAN POSITIVE	CONFIRMED SEPSIS	30 DAYS	16 DAYS	DISCHARGE
2	1669989	45	MALE	DRAN C/S= ACIENTOBACTER BAUMANII, KLEBSIELLA PNEUMONIAE	NIL	CONFIRMED SEPSIS	32 DAYS	20 DAYS	DISCHARGE
3	1711895	55	MALE	NIL	NIL	PROBABLE SEPSIS	20 DAYS	10 DAYS	DISCHARGE
4	1713039	36	MALE	DRAIN C/S= KLEBSIELLA PNEUMONIAE	NIL	CONFIRMED SEPSIS	21 DAYS	10 DAYS	DISCHARGE
5	1557949	60	FEMALE	NIL	NIL	PROBABLE SEPSIS	10 DAYS	10 DAYS	DEATH
6	57743	52	FEMALE	NIL	NIL	CONFIRMED SEPSIS	20 DAYS	8 DAYS	DISCHARGE
7	1558942	65	MALE	TISSUE C/S= PSEUDOMONAS AEROGINOSA	NIL	CONFIRMED SEPSIS	14 DAYS	5 DAYS	DISCHARGE
8	1687142	45	MALE	TISSUE C/S= NO GROWTH	NIL	PROBABLE SEPSIS	18 DAYS	6 DAYS	DISCHARGE
9	1197267	67	MALE	DRAIN C/S= SERRATIA LIGUIFACIANS	GALACTOMANNAN POSITIVE	CONFIRMED SEPSIS	30 DAYS	7 DAYS	DISCHARGE
10	1588683	68	MALE	DRAINC/S(PERITONEAL)= KLEBSIELLA PNEUMONIAE	NIL	CONFIRMED SEPSIS	21 DAYS	21 DAYS	DAMA
11	1589211	40	FEMALE	NIL	NIL	PROBABLE SEPSIS	12 DAYS	10 DAYS	DAMA
12	1570473	40	FEMALE	NIL	NIL	CONFIRMED SEPSIS	20 DAYS	15 DAYS	DISCHARGE
13	1599921	36	MALE	NIL	NIL	PROBABLE SEPSIS	18 DAYS	10 DAYS	DISCHARGE
14	1598376	44	MALE	TISSUE C/S= ECOLI	NIL	CONFIRMED SEPSIS	24 DAYS	10 DAYS	DEATH
15	1599921	36	MALE	NIL	NIL	PROBABLE SEPSIS	10 DAYS	7 DAYS	DISCHARGE
16	1599968	70	MALE	NIL	NIL	CONFIRMED SEPSIS	21 DAYS	11 DAYS	DISCHARGE
17	1600221	40	MALE	NIL	IGRA POSITIVE	CONFIRMED SEPSIS	14 DAYS	12 DAYS	DEATH
18	820419	58	MALE	NIL	NIL	CONFIRMED SEPSIS	14 DAYS	6 DAYS	DISCHARGE
19	1590787	43	MALE	NIL	NIL	PROBABLE SEPSIS	16 DAYS	7 DAYS	DISCHARGE
20	1670071	65	MALE	TISSUE C/S= E COLI	NIL	CONFIRMED SEPSIS	12 DAYS	11 DAYS	DEATH
21	1555988	53	MALE	NIL	NIL	PROBABLE SEPSIS	14 DAYS	8 DAYS	DISCHARGE
22	1541155	34	MALE	NIL	NIL	PROBABLE SEPSIS	14 DAYS	8 DAYS	DISCHARGE
23	1526692	72	FEMALE	NIL	NIL	CONFIRMED SEPSIS	10 DAYS	5 DAYS	DISCHARGE
24	553466	45	MALE	TISSUE C/S= NO GROWTH	NIL	PROBABLE SEPSIS	16 DAYS	7 DAYS	DISCHARGE
25	1393524	24	MALE	NIL	NIL	PROBABLE SEPSIS	18 DAYS	8 DAYS	DISCHARGE
26	1586381	25	MALE	DRAINC/S= KLEBSIELLS PNEUMONIAE, PSEUDOMONAS	NIL	CONFIRMED SEPSIS	25 DAYS	16 DAYS	DISCHARGE
27	1567506	69	FEMALE	TISSUE C/S= NO GROWTH	NIL	PROBABLE SEPSIS	14 DAYS	5 DAYS	DISCHARGE
28	1563919	44	MALE	DRAIN C/S= E COLI	NIL	CONFIRMED SEPSIS	14 DAYS	7 DAYS	DISCHARGE
29	1522637	70	FEMALE	NIL	NIL	PROBABLE SEPSIS	14 DAYS	4 DAYS	DISCHARGE
30	1553412	60	FEMALE	TISSUE C/S= E COLI, ENTEROCOCCUS	NIL	CONFIRMED SEPSIS	21 DAYS	7 DAYS	DISCHARGE
31	1181277	60	MALE	NIL	NIL	PROBABLE SEPSIS	21 DAYS	16 DAYS	DAMA
32	1525939	32	FEMALE	DRAIN C/S= E COLI	NIL	CONFIRMED SEPSIS	15 DAYS	7 DAYS	DISCHARGE
33	1715691	24	MALE	NIL	NIL	PROBABLE SEPSIS	10 DAYS	5 DAYS	DISCHARGE
34	1501307	61	MALE	NIL	NIL	PROBABLE SEPSIS	18 DAYS	8 DAYS	DISCHARGE

S.NO	MRD	AGE(years)	SEX	COMORBITIES	beats/min	SBP(mmHg)	DBP(mmHg)	SPO2(%)	RR(Breaths/ minute)	GCS	CNS	TEMPERATURE(°F)	BASELINE ARTERIAL BLOOD GAS
35	1588815	50	MALE	NIL	110	130	80	100	18	11	E4VTM6	99	METABOLIC ACIDOSIS
36	1491744	64	MALE	HTN,DM,HYPOTHYROID	118	108	70	98	20	15	E4V5M6	101	METABOLIC ACIDOSIS WITH RESPIRATORY ALKALOSIS
37	1528418	28	MALE	NIL	96	118	78	92	24	15	E4V5M6	99	NORMAL
38	1563544	24	MALE	NIL	130	140	60	98	20	6	E2VTM3	99	NORMAL
39	1713039	16	MALE	NIL	110	106	50	96	16	8	E2VTM5	98	NORMAL
40	1501380	72	FEMALE	HTN	100	110	64	98	20	15	E4V5M6	99	NORMAL
41	1515235	18	FEMALE	NIL	140	132	70	97	24	15	E4V5M6	98	NORMAL
42	1467606	40	MALE	NIL	120	130	70	98	17	10	E3VTM6	100	METABOLIC ACIDOSIS
43	1498306	45	MALE	NIL	132	110	70	100	20	13	E3V4M6	101	METABOLIC ACIDOSIS
44	863797	60	MALE	HTN,DM	100	132	70	95	18	7	E2VTM4	99	NORMAL
45	1549277	40	FEMALE	HTN	68	100	70	94	18	11	E4VTM6	101	NORMAL
46	1522461	50	FEMALE	NIL	100	124	64	100	20	8	E2V3M3	100	METABOLIC ACIDOSIS
47	1565344	20	FEMALE	NIL	98	120	60	100	16	7	E1VTM5	98	NORMAL
48	1567219	50	MALE	HTN	100	108	68	100	20	15	E4V5M6	98	NORMAL
49	1501051	54	MALE	COPD	110	114	76	90	24	10	E3VTM6	102	RESPIRATORY ACIDOSIS
50	580496	36	FEMALE	NIL	134	90	54	100	20	8	E2VTM5	102	METABOLIC ACIDOSIS
51	1550038	20	MALE	NIL	96	114	64	98	14	9	E4VTM4	99	NORMAL
52	1469454	60	FEMALE	HTN,DM	98	114	60	92	14	10	E3VTM6	100	METABOLIC ACIDOSIS
53	1509207	37	FEMALE	NIL	90	106	74	98	14	15	E4V5M6	98	METABOLIC ACIDOSIS
54	1531022	45	MALE	DM	98	110	64	99	12	15	E4V5M6	101	NORMAL
55	1552038	48	MALE	HTN,DM	96	114	60	98	16	14	E3V4M6	101	NORMAL
56	1510567	70	MALE	CAD	86	94	64	99	20	8	E2VTM5	100	METABOLIC ACIDOSIS
57	150499	39	FEMALE	NIL	90	110	70	97	20	11	E4VTM6	98	METABOLIC ACIDOSIS WITH RESPIRATORY ACIDOSIS
58	1552704	50	MALE	HTN,COPD	130	114	64	97	18	15	E4V5M6	100	METABOLIC ACIDOSIS
59	1557502	60	MALE	NIL	120	114	68	94	20	15	E4V5M6	98.7	METABOLIC ACIDOSIS
60	1515291	26	FEMALE	NIL	110	110	60	98	14	9	E3VTM5	99	METABOLIC ACIDOSIS
61	1564329	34	MALE	NIL	98	126	62	100	16	15	E4V5M6	100	NORMAL
62	340994	50	MALE	HTN	80	140	70	100	20	8	E3VTM4	97	NORMAL
63	1537328	65	MALE	HTN,DM	86	118	62	100	16	5	E1VTM3	98	NORMAL
64	151696	40	FEMALE	HTN,DM	88	110	54	96	20	6	E1VTM4	99	METABOLIC WITH RESPIRATORY ACIDOSIS
65	1505425	20	FEMALE	NIL	90	100	64	96	20	7	E1VTM5	100	RESPIRATORY ACIDOSIS
66	1514273	40	FEMALE	NIL	110	96	50	98	24	6	E1VTM4	101	METABOLIC ACIDOSIS
67	1504924	50	FEMALE	HTN	100	126	64	92	18	15	E4V5M6	99	NORMAL
68	348304	60	MALE	HTN,DM,HYPOTHYROID,CAD	98	136	74	98	20	11	E4VTM6	97.4	NORMAL

S.NO	MRD	AGE(years)	SEX	SOURCE	DIAGNOSIS	SOFA	MECHANICAL VENTILATION	DURATION OF MECHANICAL VENTILATION	VASOPRESSOR SUPPORT	LACTATE
35	1588815	50	MALE	ABDOMEN	C/0 PANCREATIC NECROSECTOMY	12	YES	20 DAYS	YES	5
36	1491744	64	MALE	URINARY TRACT	C/O HYDROURETERONEPHROSIS S/P RIGHT PCN	6	NO	NIL	YES	8
37	1528418	28	MALE	ABDOMEN	C/O LIVER ABSCESS WITH ASCITIS	5	NO	NIL	NO	0.7
38	1563544	24	MALE	BRAIN	LEFT MCA TERRITORY INFARCT	5	YES	7 DAYS	NO	2
39	1713039	16	MALE	BRAIN	C/O ROAD SIDE ACCIDENT WITH EXTRADURAL HEMORRHAGE	4	YES	8 DAYS	YES	2.7
40	1501380	72	FEMALE	ABDOMEN	C/0 SUB ACUTE INTESTINAL OBSTRUCTION	3	NO	NIL	NO	3.4
41	1515235	18	FEMALE	ABDOMEN	C/0 ABDOMINAL TUBERCULOSIS	4	YES	7 DAYS	YES	4
42	1467606	40	MALE	ABDOMEN	C/0 ACUTE PANCREATITIS S/P VIDEOSCOPIC ASSISTED RETROPERITONEAL DEBRIDEMENT	7	YES	3 DAYS	YES	4
43	1498306	45	MALE	ABDOMEN	C/0 ACUTE PANCREATITIS S/P VIDEOSCOPIC ASSISTED RETROPERITONEAL DEBRIDEMENT	6	NO	NIL	YES	8
44	863797	60	MALE	BRAIN	C/O INTRACRANIAL HEMORRHAGE	5	YES	8 DAYS	NO	1.2
45	1549277	40	FEMALE	SSI	C/O CERVICAL SPINE INJURY WITH SURGICAL SITE INFECTION	7	YES	3 DAYS	YES	2.3
46	1522461	50	FEMALE	ABDOMEN	C/O ACUTE LIVER FAILURE	8	YES	3 DAYS	NO	7
47	1565344	20	FEMALE	BRAIN	C/0 ROAD SIDE ACCIDENT WITH SUB DURAL HEMORRHAGE	5	YES	2 DAYS	NO	1.5
48	1567219	50	MALE	BLOOD	C/0 ROAD SIDE ACCIDENT WITH CERVICAL SPINE INJURY WITH AKI	2	NO	NIL	NO	2
49	1501051	54	MALE	LUNG	C/0 ACUTE EXACERBATION OF COPD	14	YES	4 DAYS	NO	2
50	580496	36	FEMALE	ABDOMEN	C/O PERFORATION PERITONITIS S/P EXPLORATORY LAPOROTOMY	12	YES	8 DAYS	YES	6.2
51	1550038	20	MALE	BRAIN	C/O ROAD SIDE ACCIDENT WITH EXTRADURAL HEMORRHAGE	6	YES	2 DAYS	YES	1.2
52	1469454	60	FEMALE	LUNG	C/O LOWER RESPIRATORY INFECTION WITH ACUTE KIDNEY INJURY	8	YES	8 DAYS	YES	1.2
53	1509207	37	FEMALE	ABDOMEN	C/O APPENDICULAR PERFORATION S/P EXPLORATORY LAPOROTOMY	5	YES	3 DAYS	YES	3
54	1531022	45	MALE	URINARY TRACT	C/O URINARY TRACT INFECTION WITHACUTE KIDNEY INJURY	4	NO	NIL	NO	1.4
55	1552038	48	MALE	BLOOD	C/O ACUTE FEBRILE ILLNESS WITH THROMBOCYTOPENIA	5	NO	NIL	NO	1.7
56	1510567	70	MALE	ABDOMEN	C/O INTESTINAL OBSTRUCTION S/P EXPLORATORY LAPOROTOMY	8	YES	2 DAYS	YES	4.5
57	150499	39	FEMALE	ABDOMEN	C/O DUODENAL ULCER PERFORATION S/P EXPLORATORY LAPOROTOMY	7	YES	2 DAYS	NO	1.2
58	1552704	50	MALE	BLOOD	C/O ACUTE FEBRILE ILLNESS WITH PANCYTOPENIA	6	NO	NIL	YES	2.3
59	1557502	60	MALE	ABDOMEN	P/O/C/O LAP CHOLECYSTECTOMY WITH BILE LEAK	7	NO	NIL	YES	2.6
60	1515291	26	FEMALE	ABDOMEN	C/O ABDOMINAL TUBERCULOSIS S/P EXPLORATORY LAPOROTOMY	8	YES	2 DAYS	NO	2.1
61	1564329	34	MALE	BLOOD	C/O ACUTE FEBRILE ILLNESS WITH THROMBOCYTOPENIA	4	NO	NIL	NO	2
62	340994	50	MALE	BRAIN	C/0 SUBARACHNOID HEMORRHAGE WITH ACUTE KIDNEY INJURY	6	YES	3 DAYS	NO	0.7
63	1537328	65	MALE	BRAIN	C/O INTRACEREBRAL HEMORRHAGE WITH ACUTE KIDNEY INJURY	8	YES	20 DAYS	YES	2.3
64	151696	40	FEMALE	LUNG	C/O LOWER RESPIRATORY INFECTION WITH ACUTE KIDNEY INJURY	12	YES	10 DAYS	YES	1.8
65	1505425	20	FEMALE	LUNG	C/O ALTERED SENSORIUM WITH ASPIRATION PNEUMONIA	9	YES	7 DAYS	NO	2
66	1514273	40	FEMALE	ABDOMEN	P/O/C/O PERFORATION PERITONITIS	10	YES	6 DAYS	YES	5.6
67	1504924	50	FEMALE	LUNG	C/O SHORTNESS OF BREATH WITH PULMONARY EDEMA	4	NO	NIL	NO	1.2
68	348304	60	MALE	ABDOMEN	C/O SUPERIOR MESENTERIC ARTERY THROMBOSIS	6	YES	1 DAY	NO	0.8

S.NO	MRD	AGE(years)	SEX	DAY 1 TLC(×10³/mm³)	DAY2 TLC(×10³/mm³)	DAY 3 TLC(×10³/mm³)	DAY 4 TLC(×10³/mm³)	DAY 5 TLC(×10³/mm³)	DAY 6 TLC(×10³/mm³)	DAY 7 TLC(×10³/mm³)	DAY 1 NL RATIO	DAY2 NL RATIO	DAY3 NL RATIO	DAY4 NL RATIO
35	1588815	50	MALE	13	8.3	5.7	11.5	14.5	20.8	21	5.6	3.99	2.3	10.1
36	1491744	64	MALE	22.1	23.4	22.3	19.2	18.6	20.7	27	12.85	45	48	9.7
37	1528418	28	MALE	25.3	13.6	16.3	13.1	10	10.38	7	32	11	9.13	6.96
38	1563544	24	MALE	11.9	11.9	11.4	15.1	16.1	18.6	12.4	13.6	17.7	10.6	45
39	1713039	16	MALE	6.4	16.7	14	12.5	7.2	10	11.23	1.69	8.7	9.7	6.8
40	1501380	72	FEMALE	9.8	11.1	14.1	10	7	7	6.47	6.8	12.42	10.35	7
41	1515235	18	FEMALE	32	33.12	30	28.39	28	24	24	16	20	17	10.51
42	1467606	40	MALE	33	32.5	26	24	22.71	18.61	10	18.39	17	16.91	10
43	1498306	45	MALE	48	66	44.34	-	-	-	-	34	36.51	30	-
44	863797	60	MALE	14	15.41	11	10.42	7.4	6.3	6	4.3	6	3.4	3
45	1549277	40	FEMALE	18.31	19	16.58	14	14	10.41	10	10	8.9	8	7.5
46	1522461	50	FEMALE	10	14	24.41	24	20.13	18.31	14	10	14	16.71	10
47	1565344	20	FEMALE	20.41	15	10.51	11.45	7.6	7	5	15	7.6	7	4.5
48	1567219	50	MALE	16.71	16	15.81	10.72	7.9	6	4.3	2.3	2	3.4	3.23
49	1501051	54	MALE	24.71	28.51	26	22.61	21.71	18.73	13	10.11	16.51	16	14.63
50	580496	36	FEMALE	34.41	36	35.61	28	20	18.3	15.71	26	20.5	20	10.9
51	1550038	20	MALE	20.11	22	16	16.13	15.7	14	12.1	10.2	11	9.7	8.4
52	1469454	60	FEMALE	30	26	24.1	36	37.2	38	37	10	11.6	14	15.6
53	1509207	37	FEMALE	26.3	24.4	30	28	24.6	16.5	10.5	24.6	20.4	16.4	14.1
54	1531022	45	MALE	3.9	3.9	3	4	6.7	10	11	7.6	7	6.4	4.7
55	1552038	48	MALE	16.43	25.6	24	18	18.4	17.6	14	21.4	16.4	14	10.5
56	1510567	70	MALE	18.7	18	17.6	20.6	21	20	16	10.3	11	8.7	8
57	150499	39	FEMALE	4.08	2.9	4.9	6.8	10	11.7	12	3.39	4.51	10.75	14.6
58	1552704	50	MALE	0.9	1.2	1	2.8	4.5	14	20	0.85	0.9	1.2	1.2
59	1557502	60	MALE	11.83	16.7	9.2	13.6	14	16.5	16	10.9	16.7	12.83	20.97
60	1515291	26	FEMALE	17.3	17	15	11	10	8.9	7.1	4.5	3.2	3.1	2.3
61	1564329	34	MALE	16	17.6	19	18.4	14.2	10.3	7.9	6.7	7	10.6	10
62	340994	50	MALE	10.3	11	12.6	8.4	7.9	7	5.3	3.2	4.6	5	4.6
63	1537328	65	MALE	11.4	16.4	18.6	24	24.6	19.6	19	4.5	6.7	16.5	18.4
64	151696	40	FEMALE	24.5	26	20	18.9	17.1	16.3	16	20.3	23.4	18.7	17
65	1505425	20	FEMALE	17.4	17	19	20.4	18.5	16	13.4	5.6	7	8.7	12.4
66	1514273	40	FEMALE	24	30	34.5	30.6	28	28.9	27	26.7	28.5	30	26.5
67	1504924	50	FEMALE	10	11.6	12.3	10	7.8	7	6.7	3.4	3.1	2.7	2.6
68	348304	60	MALE	16.7	18.9	16.4	10.5	8.5	7.5	7	6.7	4.5	3.5	2.9

S.NO	MRD	AGE(years)	SEX	DAY5 NL RATIO	DAY6 NL RATIO	DAY 7 NL RATIO	DAY1 MDW	DAY2 MDW	DAY3 MDW	DAY4 MDW	DAY5 MDW	DAY6 MDW	DAY7 MDW	DAY1 PCT(ng/ml)	DAY2 PCT(ng/ml)
35	1588815	50	MALE	11	14.3	19	27	27.92	35.31	36	38.4	40	40	-	-
36	1491744	64	MALE	8.4	8	10.7	31	46.57	34.87	30	23.89	24.41	26.11	-	100
37	1528418	28	MALE	5.39	3.7	3	37	25.11	23.78	23	22.87	22.12	21	-	16
38	1563544	24	MALE	26	25.85	11	21.93	24.32	31.05	31	34.34	20	26	-	-
39	1713039	16	MALE	3.6	4.8	5	40	40.82	39.1	40.8	40	41	41.3	-	-
40	1501380	72	FEMALE	6.51	3.9	3	27	28	29.71	30	27.39	25	23	-	-
41	1515235	18	FEMALE	9.8	9	8.5	43	44	40.41	40	38.94	38	37.81	-	100
42	1467606	40	MALE	9.4	8.9	8	38	37.31	33	33	28.81	28	27	-	7
43	1498306	45	MALE	-	-	-	45.6	44	43.3	-	-	-	-	-	13.4
44	863797	60	MALE	2.3	2	2	21	21.61	20	17.81	17	17.41	17	-	-
45	1549277	40	FEMALE	4.3	3.2	3	44	43.21	40	37.41	36	32	31.81	41	-
46	1522461	50	FEMALE	9.8	8.6	5.3	28	28.36	30	27.51	27	26.11	26	-	20
47	1565344	20	FEMALE	4	3.6	3.7	21.41	21	20.51	20	18	17.41	17	-	-
48	1567219	50	MALE	3	2.3	2.1	22.31	21	20.6	20.51	20.37	19.81	19	-	-
49	1501051	54	MALE	10.68	8.9	5.3	40.11	41	41	38.48	36	28.33	28	-	6
50	580496	36	FEMALE	8.3	8	5.7	41	40.1	38.5	36.1	36	28	27.4	21	-
51	1550038	20	MALE	5.6	4.3	4	23.4	23	22.5	22	21	21.3	20	-	0.9
52	1469454	60	FEMALE	18	20.4	21.7	33.12	33	32.1	37	38.5	41	42	-	-
53	1509207	37	FEMALE	12.7	8.3	4.7	38.6	38	37.51	28.43	26	24.1	24	-	4
54	1531022	45	MALE	4	3.8	3.6	30	28.4	26	25.3	25.1	22.11	22	-	3.4
55	1552038	48	MALE	7.2	6.7	4.7	39	38.4	36	32.6	27.8	27	25	-	5.7
56	1510567	70	MALE	7.5	6	5	36.7	34	33.6	33	30	30.16	28	-	-
57	150499	39	FEMALE	15	11	10.8	34.5	34	33.2	33	28.9	27	25	-	-
58	1552704	50	MALE	4.5	4.3	3.1	31.4	31	34	34.6	35	35.7	33	-	12.3
59	1557502	60	MALE	18.7	17	17.6	28.5	29	30.79	32.6	33	32.8	31	-	9.45
60	1515291	26	FEMALE	2.1	2.1	2	27	26.7	26	25	24.3	24	23	-	-
61	1564329	34	MALE	9.6	4.5	4	36	36.2	37	28.4	26.8	25	23.7	-	-
62	340994	50	MALE	4.1	3.6	3	22.1	21.4	21.1	21	20	18.9	18	-	-
63	1537328	65	MALE	20.4	18.3	17.4	23.6	25.4	27.1	28	31	31.5	30	-	-
64	151696	40	FEMALE	10.9	9.3	8.7	37.6	38	37	36.7	26.11	26	25.3	-	10.9
65	1505425	20	FEMALE	10	5.8	5	31	31.3	33	30	28.9	26.7	25	-	-
66	1514273	40	FEMALE	26	18.9	17.1	44.3	44	43.6	42.1	40	40.1	-	-	56
67	1504924	50	FEMALE	2.1	2	2.1	23.1	20.6	20	20	19.4	19	17	-	0.56
68	348304	60	MALE	2.6	2.1	2	21.9	21	21.1	20	19.7	19	18	-	-

S.NO	MRD	AGE(years)	SEX	DAY3 PCT(ng/ml)	DAY4 PCT(ng/ml)	DAY5 PCT(ng/ml)	DAY6 PCT(ng/ml)	DAY7 PCT(ng/ml)	BLOOD C/S	URINE C/S	ENDOTRACHEAL C/S
35	1588815	50	MALE	12.71	-	-	-	-	NO GROWTH	NO GROWTH	NOT SENT
36	1491744	64	MALE	-	-	-	-	2.14	NO GROWTH	E COLI	NOT SENT
37	1528418	28	MALE	-	-	-	-	-	NOT SENT	NO GROWTH	NOT SENT
38	1563544	24	MALE	-	0.4	-	-	-	NO GROWTH	NO GROWTH	ACINETOBACTER BAUMANII
39	1713039	16	MALE	14	-	-	-	-	NOT SENT	NO GROWTH	KLEBSIELLA PNEUMONIAE
40	1501380	72	FEMALE	-	-	-	-	-	NOT SENT	NO GROWTH	NOT SENT
41	1515235	18	FEMALE	-	-	-	-	26	STAPHYLOCOCCUS AUREUS	NO GROWTH	NO GROWTH
42	1467606	40	MALE	-	-	-	-	-	NOT SENT	NOT SENT	NOT SENT
43	1498306	45	MALE	-	-	-	-	-	NOT SENT	NO GROWTH	NOT SENT
44	863797	60	MALE	0.4	-	-	-	-	NO GROWTH	NO GROWTH	NO GROWTH
45	1549277	40	FEMALE	-	-	-	-	-	ACINETOBACTER BAUMANII	NO GROWTH	NO GROWTH
46	1522461	50	FEMALE	-	-	-	-	-	NO GROWTH	NO GROWTH	NO GROWTH
47	1565344	20	FEMALE	-	-	-	-	-	NOT SENT	NO GROWTH	NOT SENT
48	1567219	50	MALE	-	-	-	-	-	NO GROWTH	NO GROWTH	NOT SENT
49	1501051	54	MALE	-	-	-	-	-	NO GROWTH	NO GROWTH	ACINETOBACTER BAUMANII
50	580496	36	FEMALE	-	-	-	-	-	NO GROWTH	NO GROWTH	NOT SENT
51	1550038	20	MALE	-	-	-	-	-	NOT SENT	NO GROWTH	NOT SENT
52	1469454	60	FEMALE	-	16	-	-	-	E COLI	NO GROWTH	ACINETOBACTER BAUMANII
53	1509207	37	FEMALE	-	-	-	-	-	NOT SENT	NO GROWTH	NOT SENT
54	1531022	45	MALE	-	-	-	-	-	NO GROWTH	KLEBSIELLA PNEUMONIE	NOT SENT
55	1552038	48	MALE	-	-	-	-	-	NO GROWTH	NO GROWTH	NOT SENT
56	1510567	70	MALE	10	-	-	-	-	NO GROWTH	NO GROWTH	NOT SENT
57	150499	39	FEMALE	3.6	-	-	-	-	NOT SENT	NO GROWTH	NOT SENT
58	1552704	50	MALE	-	-	-	-	-	NO GROWTH	KLEBSIELLA OZAINAE	NOT SENT
59	1557502	60	MALE	-	-	-	-	-	NOT SENT	NO GROWTH	NOT SENT
60	1515291	26	FEMALE	2.4	-	-	-	-	NO GROWTH	NO GROWTH	NOT SENT
61	1564329	34	MALE	1.8	-	-	-	-	NOT SENT	NO GROWTH	NOT SENT
62	340994	50	MALE	0.6	-	-	-	-	NOT SENT	NOT SENT	NOT SENT
63	1537328	65	MALE	13.6	-	-	-	-	NO GROWTH	NO GROWTH	ACINETOBACTER BAUMANII
64	151696	40	FEMALE	-	-	-	-	-	NO GROWTH	NO GROWTH	KLEBSIELLA PNEUMONIAE
65	1505425	20	FEMALE	3.5	-	-	-	-	NO GROWTH	NO GROWTH	ECOLI, ACINETOBACTER
66	1514273	40	FEMALE	-	-	-	-	-	ACINETOBACTER BAUMANII	NO GROWTH	NO GROWTH
67	1504924	50	FEMALE	-	-	-	-	-	NOT SENT	NO GROWTH	NOT SENT
68	348304	60	MALE	-	-	-	-	-	NOT SENT	NO GROWTH	NOT SENT

S.NO	MRD	AGE(years)	SEX	OTHERS	SEROLOGY	SEPSIS STATUS	DURATION OF ANTIBIOTICS	LENGTH OF ICU STAY	OUTCOME
35	1588815	50	MALE	DRAIN C/S= KLEBSIELLA PNEUMONIAE	NIL	CONFIRMED SEPSIS	27 DAYS	20 DAYS	DEATH
36	1491744	64	MALE	NIL	NIL	CONFIRMED SEPSIS	20 DAYS	18 DAYS	DISCHARGE
37	1528418	28	MALE	DRAIN C/S= ECOLI	NIL	CONFIRMED SEPSIS	17 DAYS	12 DAYS	DISCHARGE
38	1563544	24	MALE	NIL	NIL	CONFIRMED SEPSIS	21 DAYS	14 DAYS	DISCHARGE
39	1713039	16	MALE	NIL	NIL	CONFIRMED SEPSIS	8 DAYS	8 DAYS	DAMA
40	1501380	72	FEMALE	NIL	NIL	PROBABLE SEPSIS	9 DAYS	9 DAYS	DAMA
41	1515235	18	FEMALE	DRAINC/S= ECOLI	NIL	CONFIRMED SEPSIS	10 DAYS	9 DAYS	DEATH
42	1467606	40	MALE	DRAIN C/S= NO GROWTH	NIL	PROBABLE SEPSIS	14 DAYS	7 DAYS	DISCHARGE
43	1498306	45	MALE	DRAIN C/S= NO GROWTH	NIL	PROBABLE SEPSIS	5 DAYS	3 DAYS	DAMA
44	863797	60	MALE	NIL	NIL	PROBABLE SEPSIS	14 DAYS	14 DAYS	DEATH
45	1549277	40	FEMALE	WOUND C/S= PSEUDOMONAS AEROGINOSA	NIL	CONFIRMED SEPSIS	14 DAYS	10 DAYS	DISCHARGE
46	1522461	50	FEMALE	NIL	NIL	PROBABLE SEPSIS	14 DAYS	12 DAYS	DISCHARGE
47	1565344	20	FEMALE	NIL	NIL	PROBABLE SEPSIS	7 DAYS	6 DAYS	DISCHARGE
48	1567219	50	MALE	NIL	NIL	PROBABLE SEPSIS	14 DAYS	12 DAYS	DISCHARGE
49	1501051	54	MALE	NIL	NIL	CONFIRMED SEPSIS	21 DAYS	10 DAYS	DISCHARGE
50	580496	36	FEMALE	TISSUE C/S= E COLI	NIL	CONFIRMED SEPSIS	20 DAYS	16 DAYS	DISCHARGE
51	1550038	20	MALE	NIL	NIL	PROBABLE SEPSIS	12 DAYS	8 DAYS	DISCHARGE
52	1469454	60	FEMALE	NIL	NIL	CONFIRMED SEPSIS	9 DAYS	8 DAYS	DEATH
53	1509207	37	FEMALE	DRAIN C/S= NO GROWTH	NIL	PROBABLE SEPSIS	14 DAYS	11 DAYS	DISCHARGE
54	1531022	45	MALE	NIL	NIL	CONFIRMED SEPSIS	21 DAYS	10 DAYS	DISCHARGE
55	1552038	48	MALE	NIL	DENGUE IGM POSITIVE	CONFIRMED SEPSIS	16 DAYS	10 DAYS	DISCHARGE
56	1510567	70	MALE	TISSUE C/S= PROTEUS MIRABILIS, KLEBSIELLA	NIL	CONFIRMED SEPSIS	30 DAYS	15 DAYS	DAMA
57	150499	39	FEMALE	DRAIN C/S= NO GROWTH	NIL	PROBABLE SEPSIS	14 DAYS	7 DAYS	DISCHARGE
58	1552704	50	MALE	NIL	NIL	CONFIRMED SEPSIS	30 DAYS	21 DAYS	DISCHARGE
59	1557502	60	MALE	DRAIN C/S= NO GROWTH	NIL	PROBABLE SEPSIS	20 DAYS	10 DAYS	DISCHARGE
60	1515291	26	FEMALE	TISSUE C/S= CBNAAT POSITIVE	NIL	CONFIRMED SEPSIS	21 DAYS	7 DAYS	DISCHARGE
61	1564329	34	MALE	NIL	NIL	PROBABLE SEPSIS	14 DAYS	8 DAYS	DISCHARGE
62	340994	50	MALE	NIL	NIL	PROBABLE SEPSIS	10 DAYS	6 DAYS	DISCHARGE
63	1537328	65	MALE	NIL	NIL	CONFIRMED SEPSIS	20 DAYS	20 DAYS	DAMA
64	151696	40	FEMALE	NIL	NIL	CONFIRMED SEPSIS	28 DAYS	34 DAYS	DAMA
65	1505425	20	FEMALE	NIL	NIL	CONFIRMED SEPSIS	27 DAYS	10 DAYS	DISCHARGE
66	1514273	40	FEMALE	TISSUE C/S= ECOLI	NIL	CONFIRMED SEPSIS	6 DAYS	6 DAYS	DEATH
67	1504924	50	FEMALE	NIL	NIL	PROBABLE SEPSIS	10 DAYS	5 DAYS	DISCHARGE
68	348304	60	MALE	NIL	NIL	PROBABLE SEPSIS	14 DAYS	6 DAYS	DISCHARGE

S.NO	MRD	AGE(years)	SEX	COMORBITIES	beats/min	SBP(mmHg)	DBP(mmHg)	SPO2(%)	RR(Breaths/ minute)	GCS	CNS	TEMPERATURE(°F)	BASELINE ARTERIAL BLOOD GAS
69	1499853	28	MALE	NIL	109	124	70	100	14	15	E4V5M6	97	NORMAL
70	1520922	56	FEMALE	NIL	134	100	60	100	16	15	E4V5M6	101	METABOLIC ACIDOSIS
71	1520928	45	MALE	NIL	123	116	64	100	24	15	E4V5M6	100	NORMAL
72	1547366	54	MALE	CAD,COPD	110	126	64	88	24	10	E3VTM6	100	RESPIRATORY ACIDOSIS
73	1589281	21	MALE	NIL	98	114	54	98	20	8	E2VTM5	102	METABOLIC ACIDOSIS
74	1541135	45	FEMALE	DM	100	110	54	98	14	15	E4V5M6	98	NORMAL
75	1581143	64	FEMALE	HTN,DM	99	106	52	97	18	11	E4VTM6	100	METABOLIC ACIDOSIS
76	1548614	70	MALE	DM	120	140	80	98	26	11	E4VTM6	101	METABOLIC ACIDOSIS WITH HYPOXEMIA
77	1550074	40	MALE	NIL	69	130	70	92	14	9	E3VTM5	97	HYPOXEMIA
78	1549318	50	FEMALE	DM	101	108	68	96	16	15	E4V5M6	97	NORMAL
79	1515635	76	MALE	COPD	110	106	64	96	20	9	E3VTM5	101.5	METABOLIC ACIDOSIS
80	1481626	40	MALE	NIL	130	108	64	98	16	15	E4V5M6	100	METABOLIC ACIDOSIS
81	1487678	56	FEMALE	DM	100	136	64	99	18	10	E3VTM6	99.2	NORMAL
82	1566040	58	FEMALE	NIL	118	108	54	89	16	9	E3VTM5	100.1	RESPIRATORY ACIDOSIS WITH HYPOXEMIA
83	1519202	60	MALE	DM	143	98	52	90	26	10	E3VTM6	99.8	RESPIRATORY ACIDOSIS WITH HYPOXEMIA
84	1300103	48	MALE	COPD	107	110	58	91	24	10	E3VTM6	99	RESPIRATORY ACIDOSIS
85	1541615	52	MALE	NIL	98	124	74	98	18	15	E4V5M6	97	NORMAL
86	1589211	56	FEMALE	1,2	85	144	68	100	12	7	E2VTM4	99	NORMAL
87	1480146	38	MALE	NIL	126	132	70	98	20	15	E4V5M6	100.1	NORMAL
88	1504023	48	MALE	NIL	132	126	60	97	18	8	E2VTM5	98.3	METABOLIC ACIDOSIS
89	1588683	40	FEMALE	NIL	110	124	48	97	20	10	E3VTM6	99	NORMAL
90	1539357	38	FEMALE	NIL	98	110	64	98	18	9	E3VTM5	101	METABOLIC ACIDOSIS
91	1501410	40	FEMALE	DM	100	106	48	97	20	15	E4V5M6	98.6	METABOLIC ACIDOSIS
92	1548647	27	FEMALE	NIL	113	108	62	98	14	11	E4VTM6	98	NORMAL
93	1588037	60	MALE	HTN,CAD	96	126	68	99	16	8	E2VTM5	99	NORMAL
94	1571354	64	MALE	DM	100	110	60	98	18	8	E2VTM5	100	METABOLIC ACIDOSIS
95	1491744	66	MALE	NIL	98	124	70	98	14	8	E2VTM5	98	NORMAL
96	1425871	46	MALE	NIL	99	110	64	100	20	9	E3VTM5	101.3	METABOLIC ACIDOSIS
97	1485254	30	MALE	NIL	87	120	70	100	16	15	E4V5M6	98	NORMAL
98	1506974	60	FEMALE	DM	100	120	64	98	14	15	E4V5M6	101	METABOLIC ACIDOSIS
99	1491615	58	MALE	DM	110	100	64	98	16	15	E4V5M6	100	NORMAL
100	1491075	34	FEMALE	NIL	98	114	54	98	20	8	E2VTM5	102	METABOLIC ACIDOSIS

S.NO	MRD	AGE(years)	SEX	SOURCE	DIAGNOSIS	SOFA	MECHANICAL VENTILATION	DURATION OF MECHANICAL VENTILATION	VASOPRESSOR SUPPORT	LACTATE
69	1499853	28	MALE	ABDOMEN	C/O ROAD SIDE ACCIDENT WITH BLUNT TRAUMA ABDOMEN WITH ACUTE KIDNEY INJURY	3	NO	NIL	NO	4.3
70	1520922	56	FEMALE	LUNG	C/O DIABETIC KETOACIDOSIS WITH LOWER RESPIRATORY TRACT INFECTION	4	NO	NIL	NO	2.1
71	1520928	45	MALE	LUNG	C/O ACUTE PANCREATITIS	4	NO	NIL	NO	0.5
72	1547366	54	MALE	LUNG	C/O ACUTE EXACERBATION OF COPD WITH PNEUMONIA	6	YES	3 DAYS	YES	0.6
73	1589281	21	MALE	BRAIN	C/O ACUTE FEBRILE ILLNESS WITH ALTERED SENSORIUM	5	YES	4 DAYS	YES	3.2
74	1541135	45	FEMALE	URINARY TRACT	C/O URINARY TRACT INFECTION WITH AKI	4	NO	NIL	NO	2.4
75	1581143	64	FEMALE	ABDOMEN	C/O SMA THROMBOSIS S/P EXPLORATORY LAPOROTOMY	7	YES	2 DAYS	YES	4.4
76	1548614	70	MALE	SSI	C/O DIABETIC FOOT RIGHT S/P DEBRIDEMENT	5	YES	3 DAYS	NO	0.5
77	1550074	40	MALE	BRAIN	C/O ROAD SIDE ACCIDENT WITH HEMORRHAGIC CONTUSIONS WITH ASPIRATION PNEUMONIA	7	YES	5 DAYS	NO	0.4
78	1549318	50	FEMALE	ABDOMEN	C/O CHOLEDOCHOLITHIASIS WITH CHOLANGITIS	3	NO	NIL	YES	4.6
79	1515635	76	MALE	ABDOMEN	C/O ILEAL PERFORATION S/P EXPLORATORY LAPAROTOMY WITH AKI	12	YES	9 DAYS	YES	6.7
80	1481626	40	MALE	LUNG	C/O ROAD SIDE ACCIDENT WITH POLYTRAUMA WITH BLUNT TRAUMA CHEST	3	NO	NIL	NO	3.1
81	1487678	56	FEMALE	ABDOMEN	C/O INTESTINAL OBSTRUCTION S/P EXPLORATORY LAPOROTOMY	5	YES	1 DAY	YES	3.4
82	1566040	58	FEMALE	LUNG	C/O LOWER RESPIRATORY TRACT INFECTION	8	YES	3 DAYS	YES	5.6
83	1519202	60	MALE	LUNG	C/O PIULMONARY TUBERCULOSIS	7	YES	4 DAYS	YES	1.2
84	1300103	48	MALE	LUNG	C/O COPD WITH TYPE II RESPIRATORY FAILURE	6	YES	5 DAYS	NO	2.1
85	1541615	52	MALE	LUNG	C/O ROAD SIDE ACCIDENT WITH BLUNT TRAUMA CHEST	4	NO	NIL	NO	2.3
86	1589211	56	FEMALE	BRAIN	C/O SUBARACHNOID HEMORRHAGE	5	YES	2 DAYS	NO	0.2
87	1480146	38	MALE	ABDOMEN	C/O ACUTE PANCREATITIS	6	YES	NIL	NO	0.8
88	1504023	48	MALE	ABDOMEN	P/O/C/O PANCREATIC NECROSECTOMY	12	YES	20 DAYS	YES	6.7
89	1588683	40	FEMALE	ABDOMEN	C/O GASTRIC PERFORATION S/P EXPLORATORY LAPOROTOMY	4	YES	1 DAY	YES	4.5
90	1539357	38	FEMALE	BLOOD	C/O FEVER WITH ALTERED SENSORIUM WITH SHOCK	6	YES	4 DAYS	YES	6.5
91	1501410	40	FEMALE	ABDOMEN	C/O ACUTE GASTROENTERITIS WITH SHOCK	8	NO	NIL	YES	8.9
92	1548647	27	FEMALE	ABDOMEN	C/O APPENDICULAR PERFORATION S/P EXPLORATORY LAPOROTOMY	3	YES	1 DAY	NO	3.4
93	1588037	60	MALE	ABDOMEN	C/O SUPERIOR MESENTERIC VEIN THROMBOSIS	7	YES	7 DAYS	YES	5.7
94	1571354	64	MALE	BLOOD	C/O FEVER WITH ALTERED SENSORIUM WITH AKI	5	YES	4 DAYS	YES	3.2
95	1491744	66	MALE	ABDOMEN	C/O PERFORATION PERITONITIS S/P EXPLORATORY LAPOROTOMY	4	YES	2 DAYS	NO	0.7
96	1425871	46	MALE	ABDOMEN	P/O/C/O PANCREATIC NECROSECTOMY	10	YES	10 DAYS	YES	7.8
97	1485254	30	MALE	BLOOD	C/O ROAD SIDE ACCIDENT WITH DORSAL SPINE INJURY	4	NO	NIL	NO	0.4
98	1506974	60	FEMALE	SSI	C/O RIGHT LOWER LIMBCELLULITIS	3	NO	NIL	NO	2.4
99	1491615	58	MALE	SSI	C/O DIABETIC FOOT RIGHT S/P DEBRIDEMENT	4	NO	NIL	YES	2.6
100	1491075	34	FEMALE	ABDOMEN	C/O PERFORATION PERITONITIS S/P EXPLORATORY LAPOROTOMY	5	YES	4 DAYS	YES	3.2

S.NO	MRD	AGE(years)	SEX	DAY 1 TLC(×10³/mm³)	DAY2 TLC(×10³/mm³)	DAY 3 TLC(×10³/mm³)	DAY 4 TLC(×10³/mm³)	DAY 5 TLC(×10³/mm³)	DAY 6 TLC(×10³/mm³)	DAY 7 TLC(×10³/mm³)	DAY 1 NL RATIO	DAY2 NL RATIO	DAY3 NL RATIO	DAY4 NL RATIO
69	1499853	28	MALE	13.4	15.6	17.4	10.8	10	7.5	7	7.8	7	7.1	4.3
70	1520922	56	FEMALE	20.2	24.5	24	15.7	15	14.7	13.6	14.5	14	16.9	15.3
71	1520928	45	MALE	13.4	20.5	15.6	15.1	14.6	14	14.8	10.12	4.5	5.6	4.3
72	1547366	54	MALE	28.9	28	27.1	18	18.1	14.8	14	26.9	22	16	14.4
73	1589281	21	MALE	30.1	30	28.14	24.31	23	22.1	20.1	20.1	19.1	26.8	27.1
74	1541135	45	FEMALE	16.72	18.9	20.2	16.7	14.2	10	7.6	8.6	13.4	17.8	12.3
75	1581143	64	FEMALE	11.9	18.9	17.4	16.3	16	14.6	12	4.5	10.2	14.5	10
76	1548614	70	MALE	11.1	19.7	17.9	15.3	28.1	19.4	19.2	3.74	10.5	10.6	5.5
77	1550074	40	MALE	13.4	16.7	20.9	19.7	15.1	12	8.9	3.4	7.9	12.3	10.2
78	1549318	50	FEMALE	26.7	28.9	24	20.1	19.3	19	18.4	8.9	11.3	12.4	8.8
79	1515635	76	MALE	20.4	24.8	30.9	29.1	24.4	25	26.7	8.2	13.4	15.6	16.1
80	1481626	40	MALE	12.1	13	14.5	20.4	20	14.12	10	4.5	5.7	6.8	10.1
81	1487678	56	FEMALE	16.7	19.4	20.4	15.7	15	11.3	11	5.6	10.4	12.7	7.8
82	1566040	58	FEMALE	24.2	28.9	30	24.32	20.15	17.13	14	10.11	15.6	21	21.6
83	1519202	60	MALE	18.4	24.9	20.5	20.1	17.9	14	16.7	11	23	26.7	20.7
84	1300103	48	MALE	22.4	23.1	26	18	18.71	16	16.71	7.8	10.8	15.7	11.8
85	1541615	52	MALE	15.8	18.9	18	17.8	10.6	8.9	5	4.5	7.6	6.5	4.5
86	1589211	56	FEMALE	10.8	12.8	13.2	7.8	6	5.9	5.4	3.2	3.4	3.7	2.9
87	1480146	38	MALE	18.9	20	21.9	19.2	19	17.8	18.9	4.5	6.7	7.1	5.6
88	1504023	48	MALE	18	24	28.9	28.2	26	22.6	23	10.3	14.3	15	12.5
89	1588683	40	FEMALE	14.5	16.7	20.6	19.2	11.6	11	7.8	6.7	10.3	14.6	11.7
90	1539357	38	FEMALE	22.9	26.7	25.13	17.8	17.1	16.3	16.1	15.9	16	23.4	23
91	1501410	40	FEMALE	27.8	28	17.9	17	14.3	14	11	11.9	12	5.6	4.7
92	1548647	27	FEMALE	16.7	18.9	14.9	11.2	8.3	7.1	7	6.7	8.9	10	4.9
93	1588037	60	MALE	14.9	15.7	20.9	22.7	19.2	19	19.3	4.5	6.7	7	8.9
94	1571354	64	MALE	3.1	2.9	2.1	4.6	10	11	12.1	10.2	11	12.5	13.8
95	1491744	66	MALE	13.7	15	14.5	11.6	10	8.9	7.1	4.5	6.7	3.4	3.3
96	1425871	46	MALE	21.3	24.6	26	26.7	24.1	28.9	27	6.4	10.9	11	13.4
97	1485254	30	MALE	11.4	12.3	10	10.3	8.3	8	7	4.5	3.5	3.3	2.9
98	1506974	60	FEMALE	20.13	22.4	24	19.5	18.9	18	17.3	10.4	13.5	21	18.9
99	1491615	58	MALE	21.14	24	25.7	22	17.8	17	14.3	4.5	6.7	12.6	14
100	1491075	34	FEMALE	30.1	30	28.14	24.31	23	22.1	20.1	20.1	19.1	26.8	27.1

S.NO	MRD	AGE(years)	SEX	DAY5 NL RATIO	DAY6 NL RATIO	DAY 7 NL RATIO	DAY1 MDW	DAY2 MDW	DAY3 MDW	DAY4 MDW	DAY5 MDW	DAY6 MDW	DAY7 MDW	DAY1 PCT(ng/ml)	DAY2 PCT(ng/ml)
69	1499853	28	MALE	4	2.4	2	22	20.1	18.9	18.1	18	17	17	-	-
70	1520922	56	FEMALE	10.9	8.7	7.6	28.6	28.9	27.1	26	24.7	24	21	-	-
71	1520928	45	MALE	3.4	3.1	2.7	21.7	23.3	23	22.7	22	21	21	-	-
72	1547366	54	MALE	10	12.5	10	36	35.6	33	28.9	28	27	27.1	8.1	-
73	1589281	21	MALE	16.7	16	15	40	41.1	38.5	36	33.7	33	28	-	10.12
74	1541135	45	FEMALE	10.7	8.7	5.4	36	37.1	37	28.3	28	26	25.6	-	6.7
75	1581143	64	FEMALE	9.8	4.5	4.3	26	26.7	25	23	22.4	21	21	-	-
76	1548614	70	MALE	22.5	9.5	5.8	36.2	36	34	34.12	36	32	32.12	-	6.7
77	1550074	40	MALE	8.3	7.6	4.3	28.1	28	27.41	25	24.3	24	23.11	-	3.4
78	1549318	50	FEMALE	7.3	5.6	4.3	37	37.1	37	30.3	28.9	27.1	26	12.9	-
79	1515635	76	MALE	12.1	12	10.9	46	46.5	47	40	40.12	38.31	37	26	-
80	1481626	40	MALE	9.2	5.4	4.1	21.7	21	20	19.18	18	18	17.13	-	0.67
81	1487678	56	FEMALE	7	5.1	3.4	26	26.71	27	23.65	23.1	22	21	-	-
82	1566040	58	FEMALE	25	18.9	10	42.3	43	44.6	44	40.21	36	28	-	11
83	1519202	60	MALE	18.9	15.7	10.8	37.8	38	38.9	36	35.1	33	32.1	45	-
84	1300103	48	MALE	11	7.6	7	28.9	28	26	25.7	24	22	22.8	-	6.7
85	1541615	52	MALE	3.1	3	2.8	20.1	20	19.17	19	19	18.8	17	-	0.9
86	1589211	56	FEMALE	2.6	2.3	2	19.8	19.1	19	18	18.9	18	17	-	-
87	1480146	38	MALE	4.8	4.1	3.9	26.1	26	26.5	26.8	27	25.64	25	25.9	-
88	1504023	48	MALE	12	10.1	7.8	37.1	38	38.9	43	40	37.3	36	8.9	-
89	1588683	40	FEMALE	10.3	6.4	4.8	28	27.6	25.7	25	23	23	22.8	-	2
90	1539357	38	FEMALE	17	11	7.3	41.9	41.6	41	37	37.8	33	32.8	-	0.6
91	1501410	40	FEMALE	3.7	3.1	2.8	34	34.5	33	32.1	29	26	26.1	-	3.7
92	1548647	27	FEMALE	4.3	3.6	3.3	24.5	23	22.1	21.9	21.3	20	20	-	-
93	1588037	60	MALE	10	12.5	13	21.7	21	28.4	28	27.6	27	27.1	-	-
94	1571354	64	MALE	8.2	8.1	7.8	33	33.4	33.7	31.1	31	29.7	28	-	-
95	1491744	66	MALE	2.9	2	2.1	26.1	25	23.3	22.3	21	21.1	21	-	-
96	1425871	46	MALE	17.8	20.5	19.8	42.3	44	44.1	43.6	40.9	38.3	38	-	8.2
97	1485254	30	MALE	2.4	2.2	2.5	21	21.5	21.1	20	19.6	19.1	19	-	-
98	1506974	60	FEMALE	10.9	7.8	8.9	30	31.2	31	28.5	27	26.8	26	-	3.6
99	1491615	58	MALE	10.5	7.3	5.4	29	29.12	34	32	28	27.1	25	-	-
100	1491075	34	FEMALE	16.7	16	15	40	41.1	38.5	36	33.7	33	28	-	10.12

S.NO	MRD	AGE(years)	SEX	DAY3 PCT(ng/ml)	DAY4 PCT(ng/ml)	DAY5 PCT(ng/ml)	DAY6 PCT(ng/ml)	DAY7 PCT(ng/ml)	BLOOD C/S	URINE C/S	ENDOTRACHEAL C/S
69	1499853	28	MALE	-	-	-	-	-	NOT SENT	NOT SENT	NOT SENT
70	1520922	56	FEMALE	4.3	-	-	-	-	NO GROWTH	NO GROWTH	NOT SENT
71	1520928	45	MALE	-	-	-	-	-	NO GROWTH	NO GROWTH	NOT SENT
72	1547366	54	MALE	-	-	-	-	-	NO GROWTH	CANDIDA TROPICALIS	KLEBSIELLA PNEUMONIAE
73	1589281	21	MALE	-	-	-	-	-	STAPHYLOCOCCUS AUREUS	NO GROWTH	NO GROWTH
74	1541135	45	FEMALE	-	-	-	-	-	NO GROWTH	E COLI	NOT SENT
75	1581143	64	FEMALE	2	-	-	-	-	NOT SENT	NO GROWTH	NOT SENT
76	1548614	70	MALE	-	-	-	-	-	NO GROWTH	NO GROWTH	NO GROWTH
77	1550074	40	MALE	-	-	-	-	-	NOT SENT	NOT SENT	NO GROWTH
78	1549318	50	FEMALE	-	-	-	-	-	NOT SENT	NOT SENT	NOT SENT
79	1515635	76	MALE	-	-	-	-	18	NO GROWTH	NO GROWTH	NO GROWTH
80	1481626	40	MALE	-	-	-	-	-	NOT SENT	NO GROWTH	NOT SENT
81	1487678	56	FEMALE	0.54	-	-	-	-	NOT SENT	NO GROWTH	NOT SENT
82	1566040	58	FEMALE	-	-	-	-	-	NO GROWTH	NO GROWTH	KLEBSIELLA PNEUMONIAE
83	1519202	60	MALE	-	-	-	-	12	NOT SENT	NO GROWTH	NO GROWTH
84	1300103	48	MALE	-	-	-	-	-	ACINETOBACTER BAUMANII	NO GROWTH	NO GROWTH
85	1541615	52	MALE	-	-	-	-	-	NOT SENT	NO GROWTH	NOT SENT
86	1589211	56	FEMALE	-	-	-	-	-	NOT SENT	NOT SENT	NOT SENT
87	1480146	38	MALE	1.9	-	-	-	-	NOT SENT	NO GROWTH	NOT SENT
88	1504023	48	MALE	-	-	-	6.9	-	KLEBSIELLA PNEUMONIAE	NO GROWTH	NO GROWTH
89	1588683	40	FEMALE	-	-	-	-	-	NOT SENT	NO GROWTH	NOT SENT
90	1539357	38	FEMALE	-	-	-	7.8	-	NO GROWTH	CANDIDA ALBICANS	NO GROWTH
91	1501410	40	FEMALE	-	-	-	-	-	NOT SENT	NOT SENT	NOT SENT
92	1548647	27	FEMALE	0.67	-	-	-	-	NOT SENT	NO GROWTH	NOT SENT
93	1588037	60	MALE	2.7	-	-	-	-	NO GROWTH	NO GROWTH	NOT SENT
94	1571354	64	MALE	6	-	-	-	-	ACINETOBACTER BAUMANII	NO GROWTH	NO GROWTH
95	1491744	66	MALE	0.9	-	-	-	-	NOT SENT	NO GROWTH	NO GROWTH
96	1425871	46	MALE	-	-	-	-	-	NO GROWTH	NO GROWTH	NO GROWTH
97	1485254	30	MALE	-	-	-	-	-	NOT SENT	NO GROWTH	NOT SENT
98	1506974	60	FEMALE	-	-	-	-	-	NO GROWTH	NO GROWTH	NOT SENT
99	1491615	58	MALE	1.7	-	-	-	-	NO GROWTH	CANDIDA TROPICALIS	NOT SENT
100	1491075	34	FEMALE	-	-	-	-	-	STAPHYLOCOCCUS AUREUS	NO GROWTH	NO GROWTH

S.NO	MRD	AGE(years)	SEX	OTHERS	SEROLOGY	SEPSIS STATUS	DURATION OF ANTIBIOTICS	LENGTH OF ICU STAY	OUTCOME
69	1499853	28	MALE	NIL	NIL	PROBABLE SEPSIS	10 DAYS	5 DAYS	DISCHARGE
70	1520922	56	FEMALE	NIL	NIL	PROBABLE SEPSIS	14 DAYS	6 DAYS	DISCHARGE
71	1520928	45	MALE	NIL	NIL	PROBABLE SEPSIS	20 DAYS	10 DAYS	DISCHARGE
72	1547366	54	MALE	NIL	NIL	CONFIRMED SEPSIS	21 DAYS	14 DAYS	DISCHARGE
73	1589281	21	MALE	NIL	NIL	CONFIRMED SEPSIS	30 DAYS	16 DAYS	DISCHARGE
74	1541135	45	FEMALE	NIL	NIL	CONFIRMED SEPSIS	14 DAYS	8 DAYS	DISCHARGE
75	1581143	64	FEMALE	TISSUE C/S= NO GROWTH	NIL	PROBABLE SEPSIS	18 DAYS	7 DAYS	DISCHARGE
76	1548614	70	MALE	TISSUE C/S= PSEUDOMONAS	NIL	CONFIRMED SEPSIS	24 DAYS	10 DAYS	DISCHARGE
77	1550074	40	MALE	NIL	NIL	PROBABLE SEPSIS	20 DAYS	7 DAYS	DISCHARGE
78	1549318	50	FEMALE	DRAINC/S= E COLI	NIL	CONFIRMED SEPSIS	21 DAYS	8 DAYS	DISCHARGE
79	1515635	76	MALE	PERITONEAL FLUID C/S= KLEBSIELLA, E COLI	BETA D GLUCAN = POSITIVE	CONFIRMED SEPSIS	9 DAYS	9 DAYS	DEATH
80	1481626	40	MALE	NIL	NIL	PROBABLE SEPSIS	20 DAYS	10 DAYS	DISCHARGE
81	1487678	56	FEMALE	TISSUE C/S= NO GROWTH	NIL	PROBABLE SEPSIS	18 DAYS	8 DAYS	DISCHARGE
82	1566040	58	FEMALE	NIL	NIL	CONFIRMED SEPSIS	25 DAYS	14 DAYS	DISCHARGE
83	1519202	60	MALE	NIL	NIL	PROBABLE SEPSIS	30 DAYS	15 DAYS	DISCHARGE
84	1300103	48	MALE	NIL	NIL	CONFIRMED SEPSIS	22 DAYS	10 DAYS	DISCHARGE
85	1541615	52	MALE	NIL	NIL	PROBABLE SEPSIS	12 DAYS	7 DAYS	DISCHARGE
86	1589211	56	FEMALE	NIL	NIL	PROBABLE SEPSIS	10 DAYS	6 DAYS	DISCHARGE
87	1480146	38	MALE	DRAIN C/S= NO GROWTH	NIL	PROBABLE SEPSIS	30 DAYS	20 DAYS	DISCHARGE
88	1504023	48	MALE	DRAIN C/S= KLEBSIELLA PNEUMONIAE	NIL	CONFIRMED SEPSIS	34 DAYS	20 DAYS	DEATH
89	1588683	40	FEMALE	NIL	NIL	PROBABLE SEPSIS	16 DAYS	7 DAYS	DISCHARGE
90	1539357	38	FEMALE	NIL	FUNGAL BIOMARKERS= POSITIVE	CONFIRMED SEPSIS	24 DAYS	15 DAYS	DISCHARGE
91	1501410	40	FEMALE	NIL	NIL	PROBABLE SEPSIS	10 DAYS	5 DAYS	DISCHARGE
92	1548647	27	FEMALE	NIL	NIL	PROBABLE SEPSIS	18 DAYS	6 DAYS	DISCHARGE
93	1588037	60	MALE	NIL	NIL	PROBABLE SEPSIS	24 DAYS	17 DAYS	DISCHARGE
94	1571354	64	MALE	NIL	DENGUE = POSITIVE	CONFIRMED SEPSIS	22 DAYS	10 DAYS	DISCHARGE
95	1491744	66	MALE	NIL	NIL	PROBABLE SEPSIS	16 DAYS	6 DAYS	DISCHARGE
96	1425871	46	MALE	TISSUE C/S= PSEUDOMONAS AEROGINOSA	NIL	CONFIRMED SEPSIS	20 DAYS	10 DAYS	DEATH
97	1485254	30	MALE	NIL	NIL	PROBABLE SEPSIS	14 DAYS	6 DAYS	DISCHARGE
98	1506974	60	FEMALE	TISSUE C/S= STAPHYLOCOCCUS AUREUS	NIL	CONFIRMED SEPSIS	20 DAYS	10 DAYS	DISCHARGE
99	1491615	58	MALE	TISSUE C/S= E COLI	NIL	CONFIRMED SEPSIS	30 DAYS	12 DAYS	DISCHARGE
100	1491075	34	FEMALE	NIL	NIL	CONFIRMED SEPSIS	31 DAYS	16 DAYS	DISCHARGE

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The Principal
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Subject:: Approval of Plan of Thesis.

This is to inform you that the Faculty of Medical Sciences in its meeting held on 25.09.2023 has approved the plan of thesis of **Arti Mona**, a student of your college for **DM Critical Care Medicine** along with the names of Supervisor/Co-Supervisor as under:-

Topic Plan of Thesis
Monocyte distribution width (mdw) as a tool for the prediction of sepsis in icu .

Supervisor	**Co-Supervisor:-**	**Co-Supervisor:-**
Dr. Pramod Sood Professor Dept. of Critical Care Medicine	Dr. Parshotam Lal Gautam Prof. & Head Dept. of Critical Care Medicine	Dr. Pavneet Kaur Professor Dept. of Pathology

The student may submit the thesis in triplicate alongwith the plan in triplicate also, to the Controller of Examinations, BFUHS, Faridkot, at least six months before the commencement of theory examination, if he/she is otherwise eligible to take the examination. He /She may be directed to attach a photocopy of this letter with the forwarding letter while submitting thesis in the University along with the letter of approval of University for change of supervisor/Co-Supervisor, change of topic, if any.

Controller of Examinations

Note :

1. *If any discrepancy found regarding topic of thesis or Supervisor/Co-Supervisor, inform undersigned within one month after issue of this letter.*

MONOCYTE DISTRIBUTION WIDTH (MDW) AS A TOOL FOR THE PREDICTION OF SEPSIS IN ICU

THESIS PROPOSAL

FOR APPROVAL OF SUBJECT OF THESIS TO BE SUBMITTED

IN PARTIAL FULFILMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

DOCTORATE OF MEDICINE

IN

CRITICAL CARE MEDICINE

OF THE

BABA FARID UNIVERSITY OF HEALTH SCIENCES
FARIDKOT

OCTOBER, 2022

DR ARTI MONA

DEPARTMENT OF CRITICAL CARE MEDICINE
DAYANAND MEDICAL COLLEGE AND HOSPITAL
LUDHIANA

ABSTRACT OF PLAN OF THESIS

Title	MONOCYTE DISTRIBUTION WIDTH (MDW) AS A TOOL FOR THE PREDICTION OF SEPSIS IN ICU
For the degree of	D.M. CRITICAL CARE MEDICINE
Name of the candidate	DR. ARTI MONA
Supervisor	Dr. Pramod Sood, Professor, Department of Critical Care Medicine, DMCH, Ludhiana
Co-supervisor(s)	Dr. Parshotam Lal Gautam, Professor & Head, Department of Critical Care Medicine, DMCH, Ludhiana Dr. Harpreet Kaur, Professor & Head, Department of Pathology, DMCH, Ludhiana
Institution	Dayanand Medical College & Hospital, Ludhiana
University	Baba Farid University of Health Sciences, Faridkot

Introduction: Since sepsis represents a life-threatening condition, without characteristic signs or symptoms, early detection for timely and appropriate management is crucial to patient survival. But only 50%of sepsis patients with documented infection produce positive blood culture. Measurement of sepsis biomarkers is largely used in current practice to improve the diagnosis accuracy. PCT and CRP are widely used biomarkers but even these have limited abilities in distinguishing sepsis from other inflammatory conditions or predicting outcomes. MDW is an in vitro hematological parameter and is available as a part of a complete blood count(CBC) and can be used in screening and diagnosis of patients with sepsis.

Aim of Study: To assess the positive predictive value of MDW as a marker of sepsis in ICU and to compare the performance of MDW alone and in combination with clinical criteria, TLC and biomarkers.

Materials & Methods: A prospective observational study shall be conducted on 100 patients admitted in ICU with suspected sepsis as per sepsis-3 guidelines.

Clinical Significance: This study will help us in earlier identification of sepsis in ICU.

Keywords: Sepsis, Monocyte Distribution Width (MDW), Procalcitonin (PCT), C-Reactive Protein (CRP), Complete Blood Count (CBC).

(Signature) Candidate	(Signature) Co-supervisor	(Signature) Co-supervisor	(Signature) Supervisor	(Signature) Principal

CERTIFICATE OF FACILITIES AVAILABLE

This is to certify that the facilities for work on the subject of thesis titled **"MONOCYTE DISTRIBUTION WIDTH (MDW) AS A TOOL FOR THE PREDICTION OF SEPSIS IN ICU"** exist in the Department of Critical Care Medicine, DMC&H, Ludhiana and will be provided to the candidate. We will see that the data being included in the thesis is genuine and is collected by the candidate herself under our supervision and guidance

Supervisor

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Date: 21/11/22

APPROVAL PROFORMA
BY
RESEARCH & ETHICAL COMMITTEE
DAYANAND MEDICAL COLLEGE & HOSPITAL, LUDHIANA

Name of candidate	DR. ARTI MONA
Department	Critical Care Medicine
Topic of Thesis	MONOCYTE DISTRIBUTION WIDTH (MDW) AS A TOOL FOR THE PREDICTION OF SEPSIS IN ICU
Likely date of appearing in PG examination	May, 2024
Date of enrollment	30th April 2022
Name of Head of Department	Dr P L Gautam
1) Supervisor **2) Co-Supervisor**	Dr Pramod Sood Dr. Parshotam Lal Gautam Dr. Harpreet Kaur
Signature of Members of Research Committee with Stamp	**Signature of Members of Ethics Committee with Stamp**
Dr. Harpreet Kaur (Professor & Head, Pathology)	Mr. R K Sharma (Legal Expert)
Dr. Jaspal Singh (Professor & Head, Surgery)	Dr. Ramit Mahajan (Associate Professor, Gastroenterology)
Dr. Dinesh Gupta (Professor & Head, Medicine)	Dr. Anu Sharma (Professor, Anatomy)
Dr. Sandeep Kaushal (Dean Academics & Professor & Head, Pharmacology)	Dr. Sandeep Kaushal (Dean Academics & Professor & Head, Pharmacology)
Dr. Gurpreet S Wander (Vice Principal)	Dr. Gurpreet S Wander (Vice Principal & Professor & Head, Cardiology)
	Dr. Gagandeep Singh (Secretary, Ethics Committee Professor & Head, Neurology)

Approved: Yes / ~~No~~

Dr. Sandeep Puri
Chairperson
Research Committee

Chairperson
Research Committee

Approved: Yes / No

Prof. Arvind Malhotra
Chairperson
Ethics Committee

Chairperson
Ethics Committee

PROFORMA

S. No. NAME: MRD: Date:

AGE/SEX:

Comorbidities-

Past medical history-

Examination

HR- BP- SPO2- RR-

CHEST- CVS- CNS-

Temperature-

Baseline ABG-

Diagnosis-

SOFA score-

- P/F ratio-
- Platelet count-
- Bilirubin
- Vasopressors on flow-
- GCS-
- Creatinine-

Mechanical ventilation- Yes/ No

Duration of mechanical ventilation-

Vasopressors-

Lactate-

Signature of Candidate **Signature of Supervisor**

INVESTIGATIONS

	DAY1	DAY2	DAY3	DAY4	DAY5	DAY6	DAY7
TLC with neutrophils							
MDW							
PCT							
CRP							

PBF-

Cultures-

Serology-

Antibiotics-

Before culture sensitivity-

After culture sensitivity-

Duration of antibiotics before culture sensitivity-

Length of stay at ICU-

Outcome

Discharge-

Mortality-

BABA FARID UNIVERSITY OF HEALTH SCIENCES, FARIDKOT

PROFORMA FOR REGISTRATION OF SUBJECT FOR DISSERTATION

1	NAME OF THE CANDIDATE AND ADDRESS	Dr. ARTI MONA VILLAGE-MATTU TEHSIL- KHOUR PINCODE- 181203 JAMMU, JAMMU AND KASHMIR.
2	NAME OF THE INSTITUTE	DAYANAND MEDICAL COLLEGE AND HOSPITAL
3	COURSE OF STUDY AND SUBJECT	D.M. CRITICAL CARE MEDICINE
4	DATE OF ADMISSION TO COURSE	30/04/2022
5	TITLE OF THE TOPIC	Monocyte Distribution Width (MDW) as a tool for the prediction of sepsis in ICU.

6.0 BRIEF RESUME OF THE INTENDED WORK

6.1 NEED FOR STUDY –

Sepsis is a complex pathology that arises from dysregulated host inflammatory responses to systemic infection.[1] Human sepsis is a leading cause of death in intensive care units (ICUs) worldwide. Yet, the immunological and molecular basis of this syndrome is poorly understood.[2]

Since sepsis represents a life-threatening condition, without characteristic signs or symptoms, early detection for timely and appropriate management is crucial to patient survival.[3]Mortality from sepsis increases by as much as 8% for every hour that treatment is delayed.[4]

Infections leading to sepsis are most commonly diagnosed using blood culture in combination with characteristic physical alterations.But only 50% of sepsis patients with documented infection produce positive blood culture, with an even lower rate of positivity when drawn in the presence of ongoing antibiotic therapy and even that it can often take days before definitive results are obtained.[5]With the absence of direct biomarkers for sepsis, blood proteins involved in the host inflammatory response, such as C-reactive protein (CRP) and procalcitonin (PCT), have been used to detect infection and predict outcomes in septic patients.

PCT and CRP are widely used biomarkers but even these have limited abilities in distinguishing sepsis from other inflammatory conditions or predicting outcomes. Nonspecific elevations in PCT levels in the absence of a bacterial infection can occur in conditions like severe trauma, surgery, cardiogenic shock, birth stress in newborns, heat shock, acute graft-versus-host disease, different types of immunotherapy, such as granulocyte transfusions, the administration of antilymphocyte globulin or anti-CD3 antibodies, therapy with cytokines or related antibodies (IL-2 or

TNF-α), autoimmune diseases such as Kawasaki disease or different types of vasculitis and paraneoplastic syndromes.[6-9]

As multiple clinical inflammatory conditions lead to systemic inflammatory response syndrome and overlap with sepsis, therefore for early diagnosis of sepsis in ICU, there is a need to have laboratory biomarkers with high predictive value. Currently used clinical criteria and biomarkers have either poor sensitivity and specificity or high cost. Thus we wish to evaluate new laboratory biomarkers of sepsis, Monocyte Distribution Width (MDW) for its predictive value in the early course of sepsis.

Monocyte Distribution Width (MDW), is a relatively simple proxy of innate monocyte response to bacterial or fungal bloodstream invasion, as a biomarker for the early recognition of sepsis.[10] MDW is available early in patient assessment as a part of a complete blood count(CBC).

MDW is an in vitro hematological parameter. MDW is the only FDA-cleared hematological biomarker that helps to establish the severity of infection and risk of sepsis in adult patients in the emergency department(ED).[11] Monocytes are one of the first responders to infection in the blood and peripheral tissue and display functional and volumetric heterogeneity.[12] During sepsis, functional reprogramming between monocytes and macrophages occurs,[13] inducing morphological changes in the monocytes; monocyte distribution width (MDW) reflects those changes and has been suggested as a marker of early sepsis in the ED.[10,14]

MDW provides information on the variability of the cellular volume of the monocyte population in the peripheral blood. Monocytes shift in the activated cellular form, moving quickly from peripheral blood to the site of infection, and change their size and volume, differentiating into amoeboid cells and increasing the expression of functional markers, e.g. CD16.[15-16] As a consequence, the accurate measurement of monocyte size as a proxy of the degree of monocyte immune activation in septic patients may

represent a viable solution to recognize the early onset of infections among patients in ICU. Therefore, measuring the spread of monocyte size in reading chambers of new generation hematologic analyzers (Beckman Coulter DxH analyzers) seems like a promising strategy to monitor ensuing sepsis.[10]

The DxH 900 and DxH 690T Beckman Coulter hematology analyzers utilize the proprietary VCSn technology to characterize the WBC in their near-native state and separate different types of WBC to generate a 5-part differential (neutrophils, eosinophils, monocytes, lymphocytes, and basophils). Through these measurements, the system gathers information about each of the WBC populations including the mean and standard deviation for each of these measurements referred to as cell morphometric parameters (formerly known as cell population data, CPD). Monocytes and neutrophils represent the first line response during infection by pathogens. The accompanying inflammatory process may result in their activation and ultimately morphological and functional changes. These morphological changes, even the slight ones, are detected by the proprietary near-native state characterization capability.[11]

The value of MDW is that it provides physicians with an earlier indication of sepsis during the initial encounter, which is especially important when a patient's symptoms are mild and alternative diagnoses are being considered. In conjunction with other clinical parameters, MDW allowsclinicians to escalate and deescalate care in patients with suspected infection.

HYPOTHESIS

Sepsis is the major cause of mortality and morbidity in ICU. Early empirical management with antibiotics and source control improves survival in these patients. There are many clinical non-infectious mimics in ICU which creates diagnostic dilemma and unnecessary use of antibiotics.

Unnecessary antibiotic use result in development of multidrug resistance as well as economical burden on the patient. There has been always a search for a reliable tool to suspect sepsis as well as high cost. Current clinical and biochemical tools have variable sensitivity and specificity. Recently Monocyte Distribution width (MDW) has been introduced in clinical practice to diagnose and monitor body's defensive response to sepsis. Thus we wish to evaluate the role of MDW in diagnosing and monitoring sepsis as well as its comparative role with available clinical criteria, laboratory, and combination of these.

6.2 REVIEW OF LITERATURE-

More than two millennia ago, Hippocrates wrote that sepsis was characterized by rotting flesh and festering wounds. Germ theory was proposed by semmelweis, Pasteur and others in the nineteenth century. In 1992, bone and colleagues proposed that the host, not the germ, was responsible for the pathogenesis of sepsis.[17]

Approximately 5 to 10% of patients with sepsis are directly hospitalized at an Intensive Care Unit (ICU) for septic shock, while 8–10% of those admitted to the ICU are at risk of developing either condition during their hospital stay. Sepsis has been reported as a major cause of increased morbidity, length of stay, and mortality among patients hospitalized in ICU for any cause.[18]

Definitions:

Sepsis 3 (2016): “Sepsis is a life-threatening organ dysfunction caused by dysregulated host response to infection”.

Clinical criteria for sepsis: Suspected or documented infection and an acute increase of ≥2 SOFA points.[19]
Septic shock is defined as a subset of sepsis in which underlying circulatory and cellular/ metabolism abnormalities lead to substantially increased mortality risk.

Clinical criteria for septic shock: suspected (ordocumented) infection plus vasopressor therapy needed to maintain mean arterial pressure at >65mmHg and serum lactate >2.0mmol/L despite adequate fluid resuscitation.[20]

Because of the high mortality rate, sepsis has for a long time been recognized by the World Health Organization as a global health priority. As per recent data, 11 million adult deaths worldwide are due to sepsis, i.e., 19.7% of deaths.[21] Last year, in its first report on the global

epidemiology and burden of sepsis, the World Health Organization (WHO) referred to sepsis as “the final common pathway to death” for severe infectious diseases, with estimated mortality for patients treated equal to 26.7% in hospital and 42.6% in ICUs, without significant differences between WHO regions.[22]

Currently, no single laboratory test or specific standalone biomarker has sufficient sensitivity and specificity to timely and accurately diagnose sepsis. Among the most available, PCT has been FDA-approved for the assessment of risk for developing sepsis in critical patients admitted to ICU, but PCT presents more than one limitation and needs to be interpreted in the clinical context.C-reactive protein is an interesting biomarker, with a low cost in comparison to PCT, with a valuable diagnostic and prognostic value, but unlikely to rule out infection as the cause of inflammation.[27] Microbiological tests, that are the “gold standard”, are evolving in modern molecular-based technologies, nanotechnology, or microfluidics for point-of-care testing, but up to 30–50% of sepsis presentations are culture negative, and viral or fungi sepsis, although very rare, should be considered in laboratory testing used for clinical evaluation of sepsis. [23]

Elisa Piva et al in their prospective observational study included 506 adult patients admitted to the ICU. MDW was evaluated in 2,367 consecutive samples received for routine complete blood counts (CBC) performed once a day and every day during the study. MDW values were significantly higher in patients with sepsis or septic shock in comparison to those within the no sepsis group. In patients that developed ICU-acquired sepsis, MDW showed an increase from 21.33 to 29.19.[23]

Ennio Polilli et al conducted a prospective observational monocentric studyand included 206 patients, 129 of whom were included in the final sample, out of which 74 (57%) had a confirmed diagnosis of sepsis. This study concluded that values of MDW > 23 were associated with a high

PPV for sepsis, whereas values of MDW ≤ 20 were associated with a high NPV.[18]

A la Woo et al prospectively enrolled 549 patients in their study on a comparison between MDW and procalcitonin and CRP for early sepsis detection in the emergency department. MDW showed the highest value in the sepsis group i.e.,24. In this study, MDW reflected a diagnostic performance comparable to that of conventional diagnostic markers, implying that MDW is an alternative biomarker and the combination of MDW and qSOFA improved the diagnostic performance for early sepsis.[24]

A blinded, observational, prospective cohort study was performed by Elliott D. Crouser et al. This study included 2158 patients and categorizedas per sepsis 2 and sepsis 3 criteria. Monocyte distribution width greater than 20.0 U distinguished sepsis from all other conditions based on either Sepsis-2 criteria or Sepsis-3 criteria. The negative predictive values for monocyte distribution width less than or equal to 20 U for Sepsis-2 and Sepsis-3 were 93% and 94%, respectively. Monocyte distribution width greater than 20.0 U combined with an abnormalWBC further improved Sepsis-2 detection.[14]

Pierre Hausfater et al conducted a blinded prospective cohort study on patients presenting to the emergencydepartment. The performance of MDW for sepsis detection was compared to that of procalcitonin (PCT) and C-reactive protein (CRP).This study concluded that MDW in combination with WBC has the diagnostic accuracy to detect sepsis, particularly when assessed in patients with lower pretest sepsis probability. Authors opined that MDW together with the qSOFA score can be used as a screening tool to improve the accuracy of sepsis diagnosis in the emergency department.[25]

6.3 AIMS AND OBJECTIVES-

PRIMARY OBJECTIVE:

- To determine the positive predictive value of MDW as a marker of sepsis in ICU.

SECONDARY OBJECTIVE:

- To compare the performance of MDW alone and in combination with clinical criteria, TLC and biomarkers.
- To study the monitoring of response to antimicrobial therapy.

7.0 MATERIAL AND METHODS:

7.1 SOURCE OF DATA:

Study design–Observational study

Study place- Intensive care unit, Dayanand medical college and hospital, Ludhiana

Sample size - 100

7.2 METHOD OF COLLECTION OF DATA

INCLUSION CRITERIA-

- Patients with age >18 years admitted to ICU
- Patients with suspected sepsis as per Sepsis Consensus 3 criteria

EXCLUSION CRITERIA-

- Patients with < 48 hours stay in ICU
- Patients with hematological disorders
- Patients on steroids
- Patients with bone marrow and solid organ transplant
- Patients with hereditary immune deficiencies
- Patients with HIV
- Patients with history of burns
- Patients with history of CKD, CLD
- Pregnant patients

STUDY PROTOCOL: This study will be performed on 100 patients with suspected sepsis during their stay in the ICU who meet the inclusion criteria. These patients will be divided into two groups one with confirmed sepsis and the other with probable infection on the basis of sepsis 3 criteria.

As per the sepsis 3 criteria- The description of each group will be as follows:

Group (1) infection (confirmed sepsis), patients with evidence of infection (positive blood culture or serology test) and

Group (2) sepsis (probable infection), patients with evidence of infection with the SOFA score being higher than two points, according to the Sepsis-3 criteria.

To avoid the inclusion of patients destined for short-term ICU stay (< 48 hours), patients will be consecutively enrolled after 48 hours of hospitalization in the ICU. Demographic and clinical characteristics of patients, past medical history, and laboratory parameters will be collected.Total leukocyte count along with MDW will be analyzed on the first day of enrollment into the study and then daily for a week.MDW values will be omitted in medical reports, because they will be assessed for research purposes only, and will be retrieved for statistical analyses. Blood culture and other investigations including biomarkers will be done with clinical suspicion of infection as advised by the physician. All determinations of MDW will be obtained from a K3EDTA whole-blood venous sample, assayed within 2 h of collection, in the same tubes of blood used for other CBC determination. During the study, our focus will be on the analysis of patients with suspicion of sepsis during their stay in the ICU and comparing those with a confirmed diagnosis of sepsis according to the definitions.

OUTCOME

Early identification of sepsis using monocyte distribution width in ICU.

STATISTICAL ANALYSIS

Calculation of Sample Size

It is assumed that the sepsis incidence rate in ICU is 8-10 %. [18]
Assumptions:

Confidence Level = 95%

Precision (d) = ± 6%

For estimation of sample size, the following formula has been used

$n = (Z2\alpha \times P \times (1-P))/d2$

Where;

$Z\alpha$ = Value of standard normal variate corresponding to α level of significance

P = Likely value of parameter (10%)

Q = 1 – P

d = Margin of errors which is a measure of precision

With these assumptions the **sample size works out as 96**

Data will be described in terms of range; mean ±standard deviation (± SD), frequencies (number of cases) and relative frequencies (percentages) as appropriate. To determine whether the data will be normally distributed, a Kolmogorov-Smirnov test will be used. Comparison of quantitative variables between the groups will be done using Student t-test and Mann Whitney U test for independent samples for parametric and non-parametric data respectively. For comparing categorical data, Chi square ($\chi 2$) test will be performed and fisher exact test will be used when the expected frequency will be less than 5. Receiver operator characteristics (ROC) curve will be done, and criterion value will be estimated depending on the specificity and sensitivity. Area under curve (AUC) will be measured. A probability value (p value)less than 0.05 will be considered statistically significant. All statistical calculations will be done using (Statistical Package for the Social Science) SPSS 21version (SPSS Inc., Chicago, IL, USA) statistical program for Microsoft Windows.

7.3 DOES THE STUDY REQUIRE ANY INVESTIGATIONS OR INTERVENTIONS TO BE CONDUCTED ON PATIENTS OR OTHER HUMANS OR ANIMALS? IF SO,PLEASE DESCRIBE BRIEFLY.

Complete blood count with monocyte distribution width.

7.4 HAS ETHICAL CLEARANCE BEEN OBTAINED FROM YOUR INSTITUTION IN CASE OF 7.3?

Yes, Attached herewith

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INFORMED PATIENT CONSENT

Date: _____

I……..D/o, W/o, S/o…….. ……am willing to participate in the study **"MONOCYTE DISTRIBUTION WIDTH (MDW) AS A TOOL FOR THE PREDICTION OF SEPSIS IN ICU".**The investigation has been explained to me in local vernacular language. I have fully understood that no extra expenditure in any form, merely for the purpose of thesis is being carried out. I am free to opt out the study any time without assigning any reason.

…….	……
Signature of the Witness	Signature of the patient / Legal representative
Name:	Name:

Signature of Candidate **Signature of Supervisor**

सूचित रोगी की सहमति

दिनांक: _____

मैं …….. डी/ओ, डब्ल्यू/ओ, एस/ओ ……| ……. मैं' **MONOCYTE DISTRIBUTION WIDTH (MDW) AS A TOOL FOR THE PREDICTION OF SEPSIS IN ICU'**अध्ययन में भाग लेने के लिए तैयार हूं। जांच के बारे में मुझे स्थानीय भाषा में समझाया गया है। मैं पूरी तरह से समझ गया हूं कि किसी भी रूप में कोई अतिरिक्त खर्च नहीं किया जा रहा है, केवलथीसिसके उद्देश्य से किया जा रहा है। मैं बिना कोई कारण बताए किसी भी समय अध्ययन से बाहर निकलने के लिए स्वतंत्र हूं।

…… …… ……

गवाह के हस्ताक्षर रोगी के हस्ताक्षर /कानूनी प्रतिनिधि

नाम नाम:

उम्मीदवार के हस्ताक्षर पर्यवेक्षक केह स्ताक्षर

ਸੂਚਿਤ ਮਰੀਜ਼ ਦੀ ਸਹਿਮਤੀ

ਤਾਰੀਖ਼: _____

I……..D/o, W/o, S/o…… ਮੈਂ **MONOCYTE DISTRIBUTION WIDTH (MDW) AS A TOOL FOR THE PREDICTION OF SEPSIS IN ICU'"** ਅਧਿਐਨ ਵਿੱਚ ਹਿੱਸਾ ਲੈਣ ਲਈ ਤਿਆਰ ਹਾਂ।ਜਾਂਚ ਮੈਨੂੰ ਸਥਾਨਕ ਭਾਸ਼ਾ ਵਿੱਚ ਸਮਝਾਈ ਗਈ ਹੈ। ਮੈਂ ਪੂਰੀ ਤਰ੍ਹਾਂ ਸਮਝ ਗਿਆ ਹਾਂ ਕਿ ਕਿਸੇ ਵੀ ਰੂਪ ਵਿੱਚ ਕੋਈ ਵਾਧੂ ਖਰਚਾ ਨਹੀਂ, ਸਿਰਫ਼ ਥੀਸਿਸ ਦੇਉਦੇਸ਼ ਲਈ ਕੀਤਾ ਜਾ ਰਿਹਾ ਹੈ। ਮੈਂ ਬਿਨਾਂ ਕਿਸੇ ਕਾਰਨ ਦੱਸੇ ਕਿਸੇ ਵੀ ਸਮੇਂ ਅਧਿਐਨ ਤੋਂ ਹਟਣ ਲਈ ਸੁਤੰਤਰ ਹਾਂ।

……. ……

ਮਰੀਜ਼ ਦੇ ਗਵਾਹ ਦੇ ਦਸਤਖਤ ਕਾਨੂੰਨੀ ਪ੍ਰਤੀਨਿਧੀ

ਨਾਮ: ਨਾਮ:

ਸੁਪਰਵਾਈਜ਼ਰ ਦੇ ਉਮੀਦਵਾਰ ਦੇ ਦਸਤਖਤ